U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

PB-273 484

Industrial Pollution Control Division Reports and Project Abstracts

Industrial Environmental Research Lab -Cincinnati, Corvallis, OR

Oct 77

United States
Environmental Protection
Agency

Office of Research and
Development

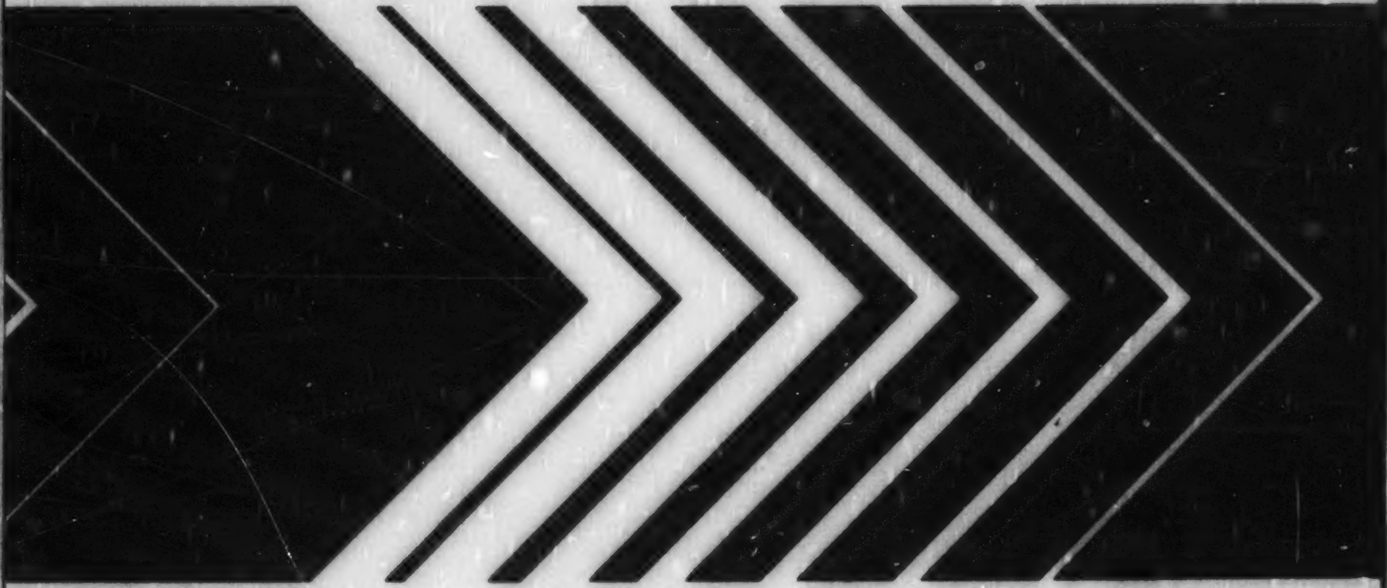
Environmental Protection
Technology Series
EPA — 600/9-77-030
October 1977

Industrial Environmental Research Laboratory, Cincinnati, Ohio

PB 273 484

EPA

Industrial Pollution Control Division Reports and Project Abstracts



REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U.S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

HOW TO ORDER

DO NOT ORDER FROM THE U.S. ENVIRONMENTAL PROTECTION AGENCY

After each bibliographic entry, one or a combination of several of the following source notations is given. (When several sources are given, any one may be used.)

ORDER FROM:	**NTIS-PB** 211 193 **NTIS-PB** 210 175 $3.00 At Printer; Pending; PB No. Pending; etc.
NTIS =	National Technical Information Service 5285 Port Royal Road Springfield, VA 22161 Use **PB order number**. A microfiche of each report listed with a PB number is available for $3.00. Paper copy prices are subject to change.
Other =	When the information indicates "Pending," "At Printer," etc., the report is not yet available. When a name and telephone number is given, contact the individual for further information.

PRICES ARE SUBJECT TO CHANGE

DO NOT ORDER FROM THE U.S. ENVIRONMENTAL PROTECTION AGENCY

EPA-600/9-77-030
October 1977

INDUSTRIAL POLLUTION CONTROL DIVISION REPORTS AND PROJECT ABSTRACTS

Edited by

James R. Boydston
IERL-Cincinnati
Corvallis Field Station
Corvallis, Oregon 97330

INDUSTRIAL ENVIRONMENTAL RESEARCH LABORATORY
OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY
CINCINNATI, OHIO 45268

DISCLAIMER

This report has been reviewed by the Industrial Environmental Research Laboratory, Cincinnati, U.S. Environmental Protection Agency, and approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

FOREWORD

When energy and material resources are extracted, processed, converted, and used, the related pollutional impacts on our environment and even on our health often require that new and increasingly more efficient pollution control methods be used. The Industrial Environmental Research Laboratory-Cincinnati (IERL-Ci) assists in developing and demonstrating new and improved methodologies that will meet these needs both efficiently and economically.

This bibliography is intended to be a reference document of all reports published by EPA and its predecessor agencies for those industrial waste research activities assigned to the Industrial Pollution Control Division of IERL-Ci. The industrial segments included are: chemicals, food products, non-ferrous metals, pulp, paper and wood products and miscellaneous industries including rubber, tanning, glass, cement, stone and asbestos.

This publication also contains abstracts of all the current projects now being conducted by the IPC Division. For further information please contact the Industrial Pollution Control Division, IERL-Cincinnati.

David G. Stephan
Director
Industrial Environmental Research Laboratory
Cincinnati

USERS' GUIDE

The Industrial Pollution Control Division of the Cincinnati Industrial Environmental Research Laboratory has responsibility for research and demonstration of new technology for treatment and process control of wastes from certain industries. This publication lists all reports and abstracts issued by this Agency and its predecessors concerned with these specific industries, and further, contains abstracts of all current projects in progress by the Division. It is assumed that the principle users of this information will be individuals interested in a specific industry or industry group. For this reason, each report has been assigned a Standard Industrial Classification (SIC) Code. These codes are used to classify the reports by industry segment and major industrial headings. The SIC Codes used are shown in the Table following.

The reports listed in this publication are found in a bibliographic section, a report abstracts section, and two indexes to simplify the location of a report. The last section of this publication contains the abstracts of all current projects. The following list provides more detailed information on the use of each section.

BIBLIOGRAPHIC SECTION

This is a bibliographic listing of all reports in numeric sequence by report number. The listing includes the SIC Code and source information. Ordering instructions are given inside the front cover.

REPORT ABSTRACTS

This section contains all available abstracts of printed reports. These abstracts are in numerical order by report numbers grouped within major industrial headings.

SIC INDEX

All report titles are listed alphabetically within the SIC Code subheading. If a reader is interested only in a certain industrial segment, a review of this index will show all reports pertaining to that industry and the report number for crossreferencing back to the bibliographic section or the abstracts section for more detailed information. "A", "An", and "The" have been dropped from the beginning of titles.

TITLE INDEX

All reports are listed alphabetically by title; "A", "An", and "The" have been dropped from the beginning of titles.

CURRENT PROJECTS ABSTRACTS SECTION

This section contains abstracts of all current inhouse, contract, and grant projects in progress in the Industrial Pollution Control Division of IERL-Cincinnati. These are listed numerically by project numbers within the major industrial headings.

EXAMPLE

If a reader is interested in finding a report or reports concerning treatment of dairy wastes, for example, he would look in the SIC Index for titles of interest and note the report number(s). He would then refer to the Bibliographic Section for source information. If interested, he could further refer to the Report Abstracts Section under "Food Products" and find a summary of the report.

Supplemental information can often be obtained by contacting the Project Officer. For the current location and telephone number of the Project Officers listed, Please contact the Industrial Pollution Control Division, IERL-Cincinnati, U.S. Environmental Protection Agency, Cincinnati, Ohio 45268. Telephone (513) 684-4314.

STANDARD INDUSTRIAL CLASSIFICATION (SIC) CODES

The SIC Codes used in this publication are shown below grouped with the major industrial headings that are within the areas or responsibility of IERL-Cincinnati.

All Industry

001	All Industry

Chemicals

280	Chemicals, General
281	Inorganic Chemicals
282	Synthetic Materials
283	Drugs
284	Soaps & Detergents
285	Paints
286	Industrial Organic Chemicals
289	Misc. Chemicals

Food Products

200	Food, General
201	Meat
202	Dairy
203	Fruit & Vegetable
204	Grain Mill Products
206	Sugar
207	Fats & Oils
208	Beverages
209	Misc. Foods

Miscellaneous

301	Rubber Tires
311	Tanning
321	Flat Glass
323	Glass Products

Miscellaneous (Continued)

324	Cement
325	Structural Clay
327	Concrete
328	Stone
329	Asbestos

Non-ferrous Metals

330	Primary Metals
333	Non-ferrous
334	Smelting Non-ferrous
335	Rolling Non-ferrous
339	Misc. Metal Production
347	Coating

Pulp, Paper & Wood

241	Forestry & Logging
242	Sawmills
249	Misc. Wood Products
260	Paper & Allied Products
261	Pulp Mills
262	Paper Mills
263	Paperboard Mills

Water & Sewage

494	Water Supply
495	Sanitary Services
721	Laundry Wastes

CONTENTS

Page

How to Order .... inside front cover

Foreword iii

User's Guide iv

Standard Industrial Classification (SIC) Codes v

Bibliographic Section 1

Report Abstracts Section 16

SIC Index 49

Title Index 57

Current Project Abstracts Section 62

BIBLIOGRAPHIC SECTION

REPORT NO.		
R2-72-016	SIC 241	**Forest Fertilization—A State of the Art Review and Description of Environmental Effects** BY W. A. Groman, National Environmental Research Center 200 SW 35th Street Corvallis, OR **ORDER FROM: NTIS-PB** 213 073 $5.25
R2-72-018	SIC 200	**Proceedings Third National Symposium on Food Processing Wastes** Pacific Northwest Water Laboratory, EPA Corvallis, OR National Canners Association Washington, DC **ORDER FROM: NTIS-PB** 214 418
R2-72-073	SIC 286	**Solvent Extraction Status Report** BY L. F. Mayhue, Robert S. Kerr Environmental Research Laboratory, EPA Ada, OK **ORDER FROM: NTIS-PB** 221 458 $2.75
R2-72-088	SIC 207	**Investigation of Odor Control in the Rendering Industry** Fats and Protein Research Foundation Incorporated Des Plaines, IL **ORDER FROM: NTIS-PB** 213 386 $3.00
R2-73-003	SIC 327	**Wastewater Treatment Studies in Aggregate and Concrete Products** BY R. G. Monroe, Smith and Monroe and Gray Engineers, Incorporated Lake Oswego, OR **ORDER FROM: NTIS-PB** 219 670
R2-73-017	SIC 203	**Cannery Waste Treatment by Anaerobic Lagoons and Oxidation Ditch** BY C. D. Parker, and G. P. Skerry, Melbourne Water Science Institute Victoria, Australia **ORDER FROM: NTIS-PB** 219 823
R2-73-024	SIC 203	**Cannery Wastewater Treatment with Rotating Biological Contactor and Extended Aeration** BY M. W. Cochrane, R. J. Burm, and K. A. Dostal, Pacific Northwest Environmental Research Laboratory, EPA Corvallis, OR **ORDER FROM: NTIS-PB** 221 333
R2-73-025	SIC 206	**Anaerobic-Aerobic Ponds for Beet Sugar Waste Treatment** Beet Sugar Development Foundation Fort Collins, CO **ORDER FROM: NTIS-PB** 227 343
R2-73-044	SIC 347	**Chemical Treatment of Plating Waste for Removal of Heavy Metals** Beaton and Corbin Manufacturing Company Southington, CT **ORDER FROM: NTIS-PB** 227 363
R2-73-085	SIC 241	**Influence of Log Handling on Water Quality** BY F. D. Schaumburg, Oregon State University Corvallis, OR **ORDER FROM: NTIS-PB** 219 824
R2-73-086	SIC 261	**Color Removal from Kraft Pulp Mill Effluents by Massive Lime Treatment** International Paper Company Springhill, LA **ORDER FROM: NTIS-PB** 219 594
R2-73-108	SIC 721	**Treatment of Laundromat Wastes** BY D.B. Aulenbach, M. Chilson, and P.C. Town, Rensselaer Polytechnic Institute Troy, NY **ORDER FROM: NTIS-PB** 227 369
R2-73-141	SIC 261	**Kraft Effluent Color Characterization Before and After Stoichiometric Lime Treatment** BY J. W. Swanson, Institute of Paper Chemistry Appleton, WI **ORDER FROM: NTIS-PB** 219 827
R2-73-164	SIC 261	**Kraft Pulping Effluent Treatment and Reuse – State of the Art** BY W. G. Timpe, E. Lang, and R. L. Miller, St. Regis Paper Company West Nyack, NY **ORDER FROM: NTIS-PB** 227 344
R2-73-178	SIC 201	**National Meat-Packing Waste Management Research and Development Program** BY J. L. Witherow, S. C. Yin, and D. M. Farmer, Robert S. Kerr Environmental Research Laboratory, EPA Ada, OK **ORDER FROM: NTIS-PB** 221 546
R2-73-184	SIC 260	**State-of-the-Art Review of Pulp and Paper Waste Treatment** BY H. Gehm, WAPORA, Incorporated Washington, DC **ORDER FROM: NTIS-PB** 221 434 $5.35
R2-73-187	SIC 281	**Neutralization of Abatement Derived Sulfuric Acid** BY W. D. Beers, Processes Research, Incorporated Cincinnati, OH **ORDER FROM: NTIS-PB** 220 362 $4.50
R2-73-191	SIC 333	**Systems Study of Conventional Combustion Sources in the Primary Aluminum Industry** BY J. Goldish, Walden Research Corporation Cambridge, MA **ORDER FROM: NTIS-PB** 226 291/AS $3.00
R2-73-194	SIC 286	**Identification and Control of Petrochemical Pollutants Inhibitory to Anaerobic Processes** BY J. C. Hovious, G. T. Waggy, and R. A. Conway, Union Carbide Corporation South Charleston, WV **ORDER FROM: NTIS-PB** 222 287
R2-73-195	SIC 249	**Aerobic Secondary Treatment of Plywood Glue Wastes** BY J. L. Graham, CH2M/HILL Corvallis, OR **ORDER FROM: NTIS-PB** 221 338

BIBLIOGRAPHIC SECTION

R2-73-196	SIC 261	**Steam Stripping Odorous Substances from Kraft Effluent Streams** BY B. F. Hrutfiord, L. N. Johanson, and J. L. McCarthy, Washington, University of Seattle, WA **ORDER FROM: NTIS-PB** 221 335
R2-73-198	SIC 203	**Low Water Volume Enzyme Deactivation of Vegetables Before Preservation** BY J. W. Ralls, National Canners Association Berkeley, CA **ORDER FROM: NTIS-PB** 221 511
R2-73-200	SIC 286	**Recondition and Reuse of Organically Contaminated Waste Sodium Chloride Brines** BY R. D. Fox, R. T. Keller, and C. J. Pinament, Dow Chemical Company Midland, MI **ORDER FROM: NTIS-PB** 222 256
R2-73-209	SIC 311	**Secondary Waste Treatment for a Small Diversified Tannery** BY E. L. Thackston, Caldwell Lace Leather Company Auburn, KY **ORDER FROM: NTIS-PB** 221 494
R2-73-232	SIC 260	**Methods for Pulp and Paper Mill Sludge Utilization and Disposal** BY T. R. Aspitarte, Crown Zellerbach Corporation Camas, WA **ORDER FROM: NTIS-PB** 222 254
R2-73-236	SIC 204	**Tertiary Treatment of Combined Domestic and Industrial Wastes** BY J. W. Lee Jr., CH2M/Hill Corvallis, OR **ORDER FROM: NTIS-PB** 222 251
R2-73-247a	SIC 333	**Water Pollution Control in the Primary Nonferrous Metals Industry, Vol. I – Copper, Zinc, and Lead Industries** Battelle Memorial Institute Columbus, OH **ORDER FROM: NTIS-PB** 229 456/AS
R2-73-247b	SIC 333	**Water Pollution Control in the Primary Nonferrous Metals Industry, Vol. II – Aluminum, Mercury, Gold, Silver, Molybdenum, and Tungsten** Battelle Memorial Institute Columbus, OH **ORDER FROM: NTIS-PB** 229 467/AS
R2-73-255	SIC 261	**Ion Exchange Color and Mineral Removal from Kraft Bleach Wastes** BY R. L. Sanks, Montana State University Bozeman, MT **ORDER FROM: NTIS-PB** 222 257
R2-73-286	SIC 327	**Screening Study for Background Information and Significant Emissions from Gypsum Product Manufacturing** Processes Research Incorporated Cincinnati, OH **ORDER FROM: NTIS-PB** 222 736 $3.50
R2-73-287	SIC 347	**Investigation of Treating Electroplaters Cyanide Waste by Electrodialysis** BY S. B. Tuwiner, RAI Research Corporation Long Island City, NY **ORDER FROM: NTIS-PB** 231 263/AS
R4-73-021	SIC 001	**Survey of Emissions and Controls for "Hazardous" and Other Pollutants, A** BY A. J. Goldberg, Office of Research and Development, Air Pollution Technology Branch, Technology Division, EPA Washington, DC **ORDER FROM: NTIS-PB** 223 568/AS $11.25
11060DPD02/71	SIC 263	**Combined Treatment of Municipal Kraft Linerboard and Fiberboard Manufacturing Wastes** Macon, City of, Board of Water Commissioners Macon, GA Georgia Kraft Company Macon, GA Armstrong Cork Company Macon, GA **ORDER FROM: NTIS-PB** 208 215
11060EOC07/69	SIC 261	**Joint Municipal and Semichemical Pulping Wastes** Erie, City of Erie, PA **ORDER FROM: NTIS-PB** 185 948
12010DIM08/70	SIC 281	**Pyrite Depression by Reduction of Solution Oxidation Potential** Utah, University of Salt Lake City, UT **ORDER FROM: NTIS-PB** 200 257
12010DPF11/71	SIC 335	**Brass Wire Mill Process Changes and Waste Abatement, Recovery and Reuse** Volco Brass and Copper Company Kenilworth, NJ **ORDER FROM: NTIS-PB** 215 697
12010DRH11/71	SIC 347	**Ultrathin Membranes for Treating Metal Finishing Effluents by Reverse Osmosis** North Star Research and Development Institute Minneapolis, MN **ORDER FROM: NTIS-PB** 208 211
12010EIE11/68	SIC 347	**State of the Art Review of Metal Finishing Waste Treatment** Battelle Memorial Institute Columbus, OH **ORDER FROM: NTIS-PB** 203 207
12010EIE03/71	SIC 347	**Investigation of Techniques for Removal of Chromium from Electroplating Wastes** Battelle Memorial Institute Columbus, OH **ORDER FROM: NTIS-PB** 215 694 $6.75
12010EIE11/71	SIC 347	**Investigation of Techniques for Removal of Cyanide from Electroplating Wastes** Battelle Memorial Institute Columbus, OH **ORDER FROM: NTIS-PB** 208 210
12020---02/70	SIC 286	**Petrochemical Effluents Treatment Practices – Summary** Engineering-Sciences, Incorporated/Texas Austin, TX **ORDER FROM: NTIS-PB** 192 310 $3.00
12020DIS01/72	SIC 286	**Anaerobic Treatment of Synthetic Organic Wastes** BY J. C. Havlous, J. A. Fisher, and R. A. Conway, Union Carbide Corporation South Charleston, WV **ORDER FROM: NTIS-PB** 211 130

BIBLIOGRAPHIC SECTION

REPORT NO.		
12020DJI06/71	SIC 282	**Wastewater Treatment Facilities for a Polyvinyl Chloride Production Plant** B. F. Goodrich Chemical Company Cleveland, OH **ORDER FROM: NTIS-PB** 211 464
12020DQC03/71	SIC 286	**Polymeric Materials for Treatment and Recovery of Petrochemical Waste** Gulf South Research Institute New Orleans, LA **ORDER FROM: NTIS-PB** 201 699
12020EEQ10/71	SIC 286	**Treatment of Wastewater from the Production of Polyhydric Organics** Dow Chemical Company, Texas Division Freeport, TX **ORDER FROM: NTIS-PB** 213 841
12020EJI07/71	SIC 281	**Inorganic Chemicals Industry Profile** Datagraphics, Incorporated Pittsburgh, PA **ORDER FROM: NTIS-PB** 206 308
12020EXG03/72	SIC 286	**Effect of Chlorination on Selected Organic Chemicals** Manufacturing Chemists Association Washington, DC **ORDER FROM: NTIS-PB** 211 160
12020GND07/71	SIC 286	**Projected Wastewater Treatment Costs in the Organic Chemicals Industry** Datagraphics, Incorporated Pittsburgh, PA **ORDER FROM: NTIS-PB** 206 429
12040DLQ08/71	SIC 261	**Slime Growth Evaluation of Treated Pulp Mill Waste** Oregon State University, Department of Microbiology Corvallis, OR **ORDER FROM: NTIS-PB** 218 491
12040EBY08/70	SIC 261	**Aerial Photographic Tracing of Pulp Mill Effluent in Marine Waters** Oregon State University Corvallis, OR **ORDER FROM: NTIS-PB** 198 232
12040EEK08/71	SIC 262	**Treatment of Selected Internal Kraft Mill Wastes in a Cooling Tower** Georgia Kraft Company Rome, GA **ORDER FROM: NTIS-PB** 208 217
12040EEL02/72	SIC 262	**Reverse Osmosis Concentration of Dilute Pulp and Paper Effluents** BY A. J. Wiley, G. A. Dubey, and I. K. Bansal, Pulp Manufacturers Research League Appleton, WI Institute of Paper Chemistry Appleton, WI **ORDER FROM: NTIS-PB** 211 184
12040EFC01/71	SIC 263	**Pollution Abatement by Fiber Modification** Washington, University of, College of Forest Resources Seattle, WA **ORDER FROM: NTIS-PB** 206 219
12040ELW12/70	SIC 261	**Aerated Lagoon Treatment of Sulfite Pulping Effluents** Crown Zellerbach Corporation Lebanon, OR **ORDER FROM: NTIS-PB** 208 212
12040EMY12/71	SIC 262	**Multi-System Biological Treatment of Bleached Kraft Effluents** Mead Corporation Chillicothe, OH **ORDER FROM: NTIS-PB** 208 213
12040ENC12/71	SIC 261	**Color Removal from Kraft Pulping Effluent by Lime Addition** Interstate Paper Corporation Riceboro, GA **ORDER FROM: NTIS-PB** 218 306
12040EUG10/69	SIC 262	**Foam Separation of Kraft Pulping Wastes** Georgia Kraft Company Rome, GA **ORDER FROM: NTIS-PB** 189 160 $3.00
12040EZZ04/70	SIC 261	**Dilute Spent Kraft Liquor Filtration through Wood Chips** North Carolina, University of, School of Forest Resources Raleigh, NC **ORDER FROM: NTIS-PB** 191 873 $3.00
12040FES07/71	SIC 262	**Sludge Material Recovery System for Manufacturers of Pigmented Papers** S. D. Warren Company, Division of Scott Paper Company Westbrook, ME **ORDER FROM: NTIS-PB** 211 026
12040FUB01/72	SIC 262	**Recycle of Papermill Waste Waters and Application of Reverse Osmosis** BY D. C. Morris, W. R. Nelson, and G. O. Walraven, Green Bay Packaging, Incorporated Green Bay, WI **ORDER FROM: NTIS-PB** 211 021
12060---03/68	SIC 203	**Potato Waste Treatment (Proceedings of a Symposium)** Idaho, University of Moscow, ID Pacific Northwest Water Laboratory, FWPCA Corvallis, OR **ORDER FROM: NTIS-PB** 208 218 $3.00
12060---03/68*	SIC 203	**Aerated Lagoon Treatment of Food Processing Wastes** BY K. A. Dostal, Pacific Northwest Water Laboratory, Water Quality Office, EPA Corvallis, OR **ORDER FROM: NTIS-PB** 214 875
12060---07/69	SIC 203	**Secondary Treatment of Potato Processing Wastes** Pacific Northwest Water Laboratory, Water Quality Office, EPA Corvallis, OR **ORDER FROM: NTIS-PB** 202 234 $6.50

BIBLIOGRAPHIC SECTION

REPORT NO.		
12060---10/69	SIC 203	**Current Practice in Potato Processing Waste Treatment** Washington, University of Seattle, WA **ORDER FROM: NTIS-PB** 189 232
12060---04/70	SIC 200	**Proceedings First National Symposium on Food Processing Wastes** National Canners Association Berkeley, CA Northwest Food Processors Association Portland, OR U.S. Department of Agriculture Albany, CA Federal Water Quality Administration Corvallis, OR **ORDER FROM: NTIS-PB** 199 709 $23.00
12060---08/70	SIC 203	**Waste Reduction in Food Canning Operations** Nationul Canners Association Berkeley, CA **ORDER FROM: NTIS-PB** 198 231
12060---10/70	SIC 203	**Treatment of Citrus Processing Wastes** Coca-Cola Company, Foods Division Orlando, FL **ORDER FROM: NTIS-PB** 202 238
12060---03/71	SIC 200	**Proceedings Second National Symposium on Food Processing Wastes** Pacific Northwest Water Laboratory, EPA Corvallis, OR National Canners Association Washington, DC **ORDER FROM: NTIS-PB** 215 517
12060DSB09/71	SIC 203	**Demonstration of a Full-Scale Waste Treatment System for a Cannery** BY L. E. Streebin, G. W. Reid, and A. C. H. Hu, Oklahoma, University of Norman, OK **ORDER FROM: NTIS-PB** 215 416
12060DSI07/71	SIC 206	**State-of-Art, Sugarbeet Processing Waste Treatment** Beet Sugar Development Foundation Fort Collins, CO **ORDER FROM: NTIS-PB** 207 646
12060DXF07/71	SIC 202	**Membrane Processing of Cottage Cheese Whey for Pollution Abatement** Crowley's Milk Company Binghamton, NY **ORDER FROM: NTIS-PB** 209 936
12060DXL01/71	SIC 203	**Reduction of Salt Content of Food Processing Liquid Waste Effluent** National Canners Association Berkeley, CA **ORDER FROM: NTIS-PB** 203 963
12060EAE09/71	SIC 203	**Trickling Filter Treatment of Fruit Processing Waste Waters** National Canners Association Berkeley, CA **ORDER FROM: NTIS-PB** 210 586
12060ECF04/70	SIC 209	**Current Practice in Seafoods Processing Waste Treatment** Oregon State University Corvallis, OR **ORDER FROM: NTIS-PB** 202 232 $3.00
12060EDK08/71	SIC 203	**Liquid Wastes from Canning and Freezing Fruits and Vegetables** National Canners Association Berkeley, CA **ORDER FROM: NTIS-PB** 209 941
12060EDZ08/71	SIC 203	**Pilot Plant Installation for Fungal Treatment of Vegetable Canning Wastes** Green Giant Company Le Suer, MN **ORDER FROM: NTIS-PB** 208 206
12060EGU03/71	SIC 202	**Dairy Food Plant Wastes and Waste Treatment Practices** Ohio State University, Department of Dairy Technology Columbus, OH **ORDER FROM: NTIS-PB** 231 372 $10.75
12060EHT07/70	SIC 203	**Use of Fungi Imperfecti in Waste Control** North Star Research and Development Institute Minneapolis, MN **ORDER FROM: NTIS-PB** 202 231
12060EHU03/71	SIC 203	**Reconditioning of Food Processing Brines** National Canners Association Berkeley, CA **ORDER FROM: NTIS-PB** 212 394
12060EHV12/70	SIC 203	**Aerobic Secondary Treatment of Potato Processing Wastes** R. T. French Company Shelley, ID **ORDER FROM: NTIS-PB** 200 623
12060EZP09/70	SIC 203	**Cannery Waste Treatment Kehr Activated Sludge** FMC Corporation Santa Clara, CA **ORDER FROM: NTIS-PB** 199 071
12060EZY08/71	SIC 203	**Complete Mix Activated Sludge Treatment of Citrus Process Wastes** Winter Garden Citrus Products Cooperative Winter Garden, FL **ORDER FROM: NTIS-PB** 210 407
12060FAD10/69	SIC 203	**Aerobic Treatment of Fruit Processing Wastes** Snokist Growers Yakima, WA **ORDER FROM: NTIS-PB** 188 506 $3.00
12060FDS11/71	SIC 201	**Elimination of Water Pollution by Packing-house Animal Paunch and Blood** Beefland International, Incorporated Council Bluffs, IA **ORDER FROM: NTIS-PB** 211 023

BIBLIOGRAPHIC SECTION

REPORT NO.		
12060FQE12/70	SIC 203	**Dry Caustic Peeling of Tree Fruit for Liquid Waste Reduction** National Canners Association Berkeley, CA **ORDER FROM: NTIS-PB** 208 209
12080EZF09/70	SIC 22[illegible]	**Phenolic Water Reuse by Diatomite Filtration** Johns-Manville Products Corporation Manville, NJ **ORDER FROM: NTIS-PB** 199 069
12120---09/69	SIC 311	**Activated Sludge Treatment of Chrome Tannery Wastes** A. C. Lawrence Company Peabody, MA **ORDER FROM: NTIS-PB** 186 158
12120---09/70	SIC 311	**Treatment of Sole Leather Vegetable Tannery Wastes** BY J. D. Eye, Cincinnati, University of Cincinnati, OH **ORDER FROM: NTIS-PB** 199 068
12120DIK12/70	SIC 311	**Anaerobic-Aerobic Lagoon Treatment for Vegetable Tanning Wastes** Virginia, University of Charlottesville, VA **ORDER FROM: NTIS-PB** 202 235
12120FYF03/72	SIC 286	**Fluidized-Bed Incineration of Selected Carbonaceous Industrial Wastes** Battelle Columbus Laboratories Columbus, OH **ORDER FROM: NTIS-PB** 211 161
12130DUJ09/71	SIC 202	**Whey Effluent Packed Tower Trickling Filtration** Quirk, Lawler and Matusky Engineers Tappan, NY Walton, Village of Walton, NY **ORDER FROM: NTIS-PB** 210 408
12130EDX07/70	SIC 262	**Joint Treatment of Municipal Sewage and Pulp Mill Effluents** Green Bay Metropolitan Sewerage District Green Bay, WI **ORDER FROM: NTIS-PB** 216 843
12130EGK06/71	SIC 286	**Biological Treatment of Chlorophenolic Waste.** Jacksonville, City of Jacksonville, AR **ORDER FROM: NTIS-PB** 206 813
12130EZR05/71	SIC 203	**Combined Treatment of Domestic and Industrial Wastes by Activated Sludge** Dallas, City of Dallas, TX **ORDER FROM: NTIS-PB** 205 206
12130FJQ06/71	SIC 209	**Pollution Abatement and By-Product Recovery in Shellfish and Fisheries Processing** Food, Chemical and Research Laboratories, Incorporated Seattle, WA Engineering-Science of Alaska Anchorage, AK **ORDER FROM: NTIS-PB** 208 214
13010---02/70	SIC 241	**Industrial Waste Guide on Logging Practices** FWPCA, Northwest Region Portland, OR **ORDER FROM: NTIS-PB** 207 644 $3.00
13010EGA02/71	SIC 241	**Studies on Effects of Watershed Practices on Streams** Oregon State University Corvallis, OR **ORDER FROM: NTIS-PB** 218 266
600/1-75-005	SIC 286	**Vapor-Phase Organic Pollutants – Volatile Hydrocarbons and Oxidation Products** National Academy of Sciences Washington, DC **ORDER FROM: NTIS-PB** 249 357/AS $16.25
600/1-77-003	SIC 333	**Copper** National Academy of Sciences Washington, DC **ORDER FROM: NTIS-PB** 262 425 $7.50
600/2-74-009b	SIC 289	**State-of-The-Art For The Inorganic Chemicals Industry: Commercial Explosives** BY J. Patterson, Illinois Institute of Technology Chicago, IL **ORDER FROM: NTIS-PB** 240 960 $4.75
600/2-74-009c	SIC 281	**State-of-The-Art For The Inorganic Chemicals Industry: Industrial Inorganic Gases** BY J. Patterson, Illinois Institute of Technology Chicago, IL **ORDER FROM: NTIS-PB** 240 961/AS $4.25
600/2-75-001	SIC 001	**Projects in the Industrial Pollution Control Division – December 1974** Industrial Pollution Control Division, EPA Washington, DC **ORDER FROM: NTIS-PB** 243 892/AS $11.25
600/2-75-028	SIC 347	**Electrolytic Treatment of Job Shop Metal Finishing Wastewater** BY B. E. Warner, New England Plating Company, Inc. Worcester, MA **ORDER FROM: NTIS-PB** 246 560/AS $6.75
600/2-75-066	SIC 281	**Molecular Sieve Control Process in Sulfuric Acid Plants** BY D. W. Hissong, Battelle Columbus Laboratories Columbus, OH **ORDER FROM: NTIS-PB** 249 563/AS $5.00
600/2-76-008	SIC 333	**SO_2 Control Processes for Non-Ferrous Smelters** BY J. C. Mathews, F. L. Bellegia, C. H. Gooding, and G. E. Weant, Research Triangle Institute Research Triangle Park, NC **ORDER FROM: NTIS-PB** 251 409/AS $10.75

BIBLIOGRAPHIC SECTION

REPORT NO.		
600/2-76-009	SIC 207	**Odor Control by Scrubbing in the Rendering Industry** BY R. H. Snow, and J. E. Huff, IIT Research Institute Des Plaines, IL BY W. Boehme, Fats and Proteins Research Foundation, Inc. Des Plaines, IL **ORDER FROM: NTIS-PB** 251 187/AS $7.75
600/2-76-010	SIC 281	**Sulfuric Acid Plant Emissions During Start-up, Shutdown, and Malfunction** BY E. L. Calvin, and F. D. Kodras, Catalytic, Inc. Charlotte, NC **ORDER FROM: NTIS-PB** 249 508/AS $10.50
600/2-76-011	SIC 347	**Thor V Solventless Metal Decorating for Three-Piece Cans— Background** BY J. W. Capron, and R. C. Heininger, Continental Can Corporation Chicago, IL **ORDER FROM: NTIS-PB** 249 484/AS $3.50
600/2-76-014	SIC 281	**Molecular Sieve Mercury Control Process in Chlor-Alkali Plants** BY M. Y. Anastas, Battelle Columbus Laboratories Columbus, OH **ORDER FROM: NTIS-PB** 251 203/AS $4.50
600/2-76-017	SIC 281	**Renovation of Industrial Inorganic Wastewater by Evaporation with Interface Enhancement** BY H. H. Sephton, California, University of, Sea Water Conversion Laboratory Richmond, CA **ORDER FROM: NTIS-PB** 252 025/AS $4.50
600/2-76-032b	SIC 321	**Source Assessment: Flat Glass Manufacturing Plants** BY R. B. Reznik, Monsanto Research Corporation Dayton, OH **ORDER FROM: NTIS-PB** 252 356/AS $6.75
600/2-76-032d	SIC 286	**Source Assessment: Phthalic Anhydride** BY R. W. Serth, and T. W. Hughes, Monsanto Research Corporation Dayton, OH **ORDER FROM: NTIS-PB** 256 310
600/2-76-036a	SIC 333	**Design and Operating Parameters for Emission Control Studies: White Pine Copper Smelter** BY I. J. Weisenberg, and J. C. Serne, Pacific Environmental Services, Inc. Santa Monica, CA **ORDER FROM: NTIS-PB** 251 754/AS $4.00
600/2-76-036b	SIC 333	**Design and Operating Parameters for Emission Control Studies: Kennecott, Hayden, Copper Smelter** BY I. J. Weisenberg, and J. C. Serne, Pacific Environmental Services, Inc. Santa Monica, CA **ORDER FROM: NTIS-PB** 251 755/AS $4.50
600/2-76-036c	SIC 333	**Design and Operating Parameters for Emission Control Studies: Kennecott, McGill, Copper Smelter** BY I. J. Weisenberg, and J.C. Serne, Pacific Environmental Services, Inc. Santa Monica, CA **ORDER FROM: NTIS-PB** 251 756/AS $4.00
600/2-76-036d	SIC 333	**Design and Operating Parameters for Emission Control Studies: Kennecott, Hurley, Copper Smelter** BY I. J. Weisenberg, and J. C. Serne, Pacific Environmental Services, Inc. Santa Monica, CA **ORDER FROM: NTIS-PB** 251 757/AS $4.00
600/2-76-036e	SIC 333	**Design and Operating Parameters for Emission Control Studies: Magma, San Manuel, Copper Smelter** BY I. J. Weisenberg, and J. C. Serne, Pacific Environmental Services, Inc. Santa Monica, CA **ORDER FROM: NTIS-PB** 251 758/AS $4.00
600/2-76-036f	SIC 333	**Design and Operating Parameters for Emission Control Studies: Phelps Dodge, Ajo, Copper Smelter** BY I. J. Weisenberg, and J. C. Serne, Pacific Environmental Services, Inc. Santa Monica, CA **ORDER FROM: NTIS-PB** 251 759/AS $4.50
600/2-76-036g	SIC 333	**Design and Operating Parameters for Emission Control Studies: Phelps Dodge, Morenci, Copper Smelter** BY I. J. Weisenberg, and J. C. Serne, Pacific Environmental Services, Inc. Santa Monica, CA **ORDER FROM: NTIS-PB** 251 760/AS $3.50
600/2-76-036h	SIC 333	**Design and Operating Parameters for Emission Control Studies: Phelps Dodge, Douglas, Copper Smelter** BY I. J. Weisenberg, and J. C. Serne, Pacific Environmental Services, Inc. Santa Monica, CA **ORDER FROM: NTIS-PB** 251 761/AS $4.00
600/2-76-036i	SIC 333	**Design and Operating Parameters for Emission Control Studies: ASARCO, El Paso, Copper Smelter** BY I. J. Weisenberg, and J. C. Serne, Pacific Environmental Services, Inc. Santa Monica, CA **ORDER FROM: NTIS-PB** 251 762/AS $4.00
600/2-76-036j	SIC 333	**Design and Operating Parameters for Emission Control Studies: ASARCO, Hayden, Copper Smelter** BY I. J. Weisenberg, and J. C. Serne, Pacific Environmental Services, Inc. Santa Monica, CA **ORDER FROM: NTIS-PB** 251 763/AS $4.00

BIBLIOGRAPHIC SECTION

REPORT NO.		
600/2-76-036k	SIC 333	**Design and Operating Parameters for Emission Control Studies: ASARCO, Tacoma, Copper Smelter** BY I. J. Weisenberg, and J. C. Serne, Pacific Environmental Services, Inc. Santa Monica, CA **ORDER FROM: NTIS-PB** 251 764/AS $4.00
600/2-76-047	SIC 281	**Molecular Sieve Tests for Control of Sulfuric Acid Plant Emissions** BY K. R. Baldt, and R. F. Timmons, York Research Corporation Stamford, CT **ORDER FROM: NTIS-PB** 258 676
600/2-76-051b	SIC 286	**Environmental Catalog of Industrial Processes, Volume II— Industrial Organic Chemicals** BY T. Parsons, Radian Corporation Austin, TX **ORDER FROM:** Pending
600/2-76-053	SIC 286	**Hydrocarbon Emissions Reduction From Ethylene Dichloride Processes** BY W. S. Amato, B. Bandyopadhyay, B. E. Kurtz, and R. H. Fitch, Allied Chemical Corporation Solvay, NY **ORDER FROM: NTIS-PB** 255 837
600/2-76-065	SIC 329	**Assessment of Particle Control Technology for Enclosed Asbestos Sources—Phase II** BY P. C. Siebert, T. C. Ripley, and C. F. Harwood, IIT Research Institute Chicago, IL **ORDER FROM: NTIS-PB** 251 623/AS $6.00
600/2-76-089a	SIC 324	**Technical Manual for Measurement of Fugitive Emissions: Upwind/Downwind Sampling Method for Industrial Emissions** BY H. J. Kolnsberg, Research Corporation of New England Wethersfield, CT **ORDER FROM: NTIS-PB** 253 092/AS $5.00
600/2-76-090	SIC 242	**Clean Fuels from Agricultural and Forestry Wastes** BY J. W. Tatom, A. R. Colcord, J. A. Knight, and L. W. Elston, Georgia Institute of Technology Atlanta, GA **ORDER FROM: NTIS-PB** 259 956
600/2-76-119	SIC 281	**Effect of Equipment Maintenance and Age on Sulfuric Acid Plant Emissions** BY E. L. Calvin, and F. D. Kodras, Catalytic, Inc. Charlotte, NC **ORDER FROM: NTIS-PB** 253 947/AS $5.00
600/2-76-122	SIC 286	**Technical Manual for Process Sampling Strategies for Organic Materials** BY W. Feairheller, P. J Marn, D. H. Harris, and D. L. Harris, Monsanto Research Corporation Dayton, OH **ORDER FROM: NTIS-PB** 256 696
600/2-76-123	SIC 286	**Treatment and Disposal of Complex Industrial Wastes** BY C. Schimmel, and D. Griffin, Reichhold Chemicals, Inc. Tuscaloosa, AL **ORDER FROM: NTIS-PB** 262 979
600/2-76-141	SIC 262	**Particulate Collection Efficiency Measurements on an Electrostatic Precipitator Installed on a Paper Mill Recovery Boiler** BY J. P. Gooch, and G. H. Marchant Jr., Southern Research Institute Birmingham, AL **ORDER FROM: NTIS-PB** 255 297
600/2-76-160a	SIC 200	**IERL-RTP Procedures Manual: Level 1 Environmental Assessment** BY J. W. Hamersma, S. L. Reynolds, and R. F. Maddalone, TRW Systems Group Redondo Beach, CA **ORDER FROM: NTIS-PB** 257 850
600/2-76-164	SIC 324	**Evaluation of Rexnord Gravel Bed Filter** BY J. D. McCain, Southern Research Institute Birmingham, AL **ORDER FROM: NTIS-PB** 255 095
600/2-76-194	SIC 324	**Elimination of Water Pollution by Recycling Cement Plant Kiln Dust** BY N. R. Greening, F. M. Miller, C. H. Weise, and H. Nagao, Portland Cement Association Skokie, IL **ORDER FROM: NTIS-PB** 259 000 $4.50
600/2-76-195	SIC 286	**Evaluation and Upgrading of a Multi-Stage Trickling Filter Facility** BY J. H. Koon, R. F. Curran, C. E. Adams Jr., and W. W. Eckenfelder Jr., AWARE, Inc. Nashville, TN **ORDER FROM: NTIS-PB** 265 471 $6.75
600/2-76-197	SIC 347	**New Membranes for Treating Metal Finishing Effluents by Reverse Osmosis** BY R. J. Petersen, and K. E. Cobian, Midwest Research Institute Minneapolis, MN **ORDER FROM: NTIS-PB** 265 363 $4.50
600/2-76-199	SIC 334	**Operation of a Sulfuric Acid Plant Using Blended Copper Smelter Gases** BY B. H. Carpenter, Research Triangle Institute Research Triangle Park, NC **ORDER FROM: NTIS-PB** 258 649/as $4.50
600/2-76-211	SIC 281	**Construction of a Prototype Sulfuric Acid Mist Monitor** BY W. S. Eaton, and D. L. Strehler, Rockwell International Corporation Newbury Park, CA **ORDER FROM: NTIS-PB** 265 613 $4.50
600/2-76-213a	SIC 289	**State-of-the-Art: Military Explosives and Propellants Production Industry. Volume I – The Military Explosives and Propellants Industry** BY J. Patterson, J. Brown, W. Duckert, J. Polson, and N. I. Shapira, American Defense Preparedness Association Washington, DC **ORDER FROM: NTIS-PB** 265 385 $5.50
600/2-76-213b	SIC 289	**State-of-the-Art: Military Explosives and Propellants Production Industry. Volume II – Wastewater Characterization** BY J. Patterson, J. Brown, W. Duckert, J. Polson, and N. I. Shapira, American Defense Preparedness Association Washington, DC **ORDER FROM: NTIS-PB** 260 918

BIBLIOGRAPHIC SECTION

REPORT NO.		
600/2-76-213c	SIC 289	**State-of-the-Art: Military Explosives and Propellants Production Industry. Volume III – Wastewater Treatment** BY J. Patterson, J. Brown, W. Duckert, J. Polson, and N. I. Shapira, American Defense Preparedness Association Washington, DC **ORDER FROM: NTIS-PB** 265 042 $7.50
600/2-76-214	SIC 201	**Workshop on In-Plant Waste Reduction in the Meat Industry** BY J. L. Witherow, and J. F. Scaief, Industrial Environmental Research Laboratory, EPA Corvallis, OR **ORDER FROM: NTIS-PB** 258 742/as $6.75
600/2-76-221	SIC 261	**Removal of Soluble BODs in Primary Clarifiers** BY G. A. Dubey, A. J. Wiley, and J. W. Collins, Institute of Paper Chemistry Appleton, WI **ORDER FROM: NTIS-PB** 259 919/as $6.75
600/2-76-223	SIC 281	**Dialysis for Concentration and Removal of Industrial Wastes** BY J. K. Smith, S. V. Desai, R. E. C. Weaver, and E. Klein, Gulf South REsearch Institute New Orleans, LA **ORDER FROM: NTIS-PB** 265 572 $5.00
600/2-76-224	SIC 200	**Proceedings of the Sixth National Symposium on Food Processing Wastes** Industrial Environmental Research Laboratory, EPA Corvallis, OR **ORDER FROM: NTIS-PB** 266 360 $12.50
600/2-76-227	SIC 289	**Naval Stores Wastewater Pruification and Reuse by Activated Carbon Treatment** BY F. H. Gardner Jr., and A. R. Williamson, Hercules, Inc. Hattiesburg, MS **ORDER FROM: NTIS-PB** 261 168
600/2-76-230	SIC 311	**Leather Tanning and Finishing Waste Management Research and Development Program** BY J. F. Scaief, Industrial Environmental Research Laboratory, EPA Corvallis, OR **ORDER FROM: NTIS-PB** 264 922 $4.00
600/2-76-231	SIC 249	**Treating Wood Preserving Plant Wastewater by Chemical and Biological Methods** BY J. T. White, T. A. Bursztynsky, J. D. Crane, and R. H. Jones, Koppers Company Carbondale, IL **ORDER FROM: NTIS-PB** 265 454 $5.50
600/2-76-232	SIC 263	**Water Reuse in a Paper Reprocessing Plant** BY L. E. Streebin, G. W. Reid, P. Law, and C. Hogan, Big Chief Roofing Company Ardmore, OK **ORDER FROM: NTIS-PB** 265 232 $5.00
600/2-76-236	SIC 203	**Anaerobic and Aerobic Treatment of Combined Potato Processing Municipal Wastes** BY J. K. Neel, J. W. Vennes, G. O. Fossum, and F. B. Orthmeyer, Grand Forks, City of Grand Forks, ND **ORDER FROM: NTIS-PB** 265 009 $6.00
600/2-76-252	SIC 262	**Papermill Wastewater Treatment by Microstraining** BY F. R. Bliss, Strathmore Paper Company Turner Falls, MA **ORDER FROM:** Pending
600/2-76-253	SIC 203	**Cannery Waste Biological Sludge Disposal as Cattle Feed** BY L. A. Esvelt, Bovay Engineers, Inc. Spokane, WA **ORDER FROM: NTIS-PB** 265 357 $4.50
600/2-76-254	SIC 202	**Elimination of pollution from Cottage Cheese Whey by Drying and Utilization** BY S. Boxer, and R. W. Bond, Dairy Research and Development Corporation Peekskill, NY **ORDER FROM: NTIS-PB** 266 265 $4.50
600/2-76-260	SIC 301	**Industrial Wastewater Reclamation with a 400,000-Gallon-Per-Day Vertical Tube Evaporator** BY W. C. Long, J. H. Crozier, F. P. Drace, and K. H. Pearson, General Tire and Rubber Company Akron, OH **ORDER FROM: NTIS-PB** 265 361 $5.50
600/2-76-261	SIC 347	**Treatment of Elctroplating Wastes by Reverse Osmosis** BY R. G. Donnelly, R. L. Goldsmith, K. J. McNulty, D. C. Grant, and M. Tan, American Electroplaters' Society East Orange, NJ **ORDER FROM: NTIS-PB** 265 393 $5.50
600/2-76-262	SIC 241	**Effects of Log Handling and Storage of Water Quality** BY G. S. Schuytema, and R. D. Shankland, Industrial Environmental Research Laboratory, EPA Corvallis, OR **ORDER FROM: NTIS-PB** 266 267 $5.00
600/2-76-269	SIC 323	**Source Assessment: Glass Container Manufacturing Plants** BY J. R. Schorr, D. T. Hooie, P. R. Sticksel, and C. Brockway, Battelle Columbus Laboratories Columbus, OH **ORDER FROM: NTIS-PB** 262 002
600/2-76-270	SIC 286	**Converting Chlorohydrocarbon Wastes by Chlorolysis** BY J. K. Shiver, Repro Chemical Corporation Washington, DC **ORDER FROM: NTIS-PB** 259 935/as $4.50
600/2-76-294	SIC 207	**Treatment of Effluent Waters from Vegetable Oil Refining** BY D. F. Gill, and J. C. Ielease, Archer Daniels Midland Company Decatur, IL **ORDER FROM:** Pending
600/2-76-296	SIC 347	**Metal Removal and Cyanide Destruction in Plating Wastewaters Using Particle Bed Electrodes BY W. Chen, H. L. Recht, and G. P. Hajela, Rockwell International Corporation Canoga Park, CA** ORDER FROM: NTIS-PB **266 138 $4.50**

BIBLIOGRAPHIC SECTION

REPORT NO.		
600/2-76-301	SIC 333	**Assessment of Technology for Possible Utilization of Bayer Process Muds** BY B. K. Parekh, and W. M. Goldberger, Battelle Memorial Institute Columbus, OH **ORDER FROM:** Pending
600/2-76-302	SIC 201	**Treatment of High Strength Meatpacking Plant Wastewater by Land Application** BY A. J. Torquin, Texas, University of El Paso, TX **ORDER FROM:** Pending
600/2-76-303	SIC 333	**Methodology for Assessing Environmental Implications and Technologies: Nonferrous Metals Industries** BY E. S. Bartlett, and R. A. Wood, Battelle Columbus Laboratories Columbus, OH **ORDER FROM: NTIS-PB** 265 476 $5.00
600/2-76-304	SIC 200	**Proceedings: Seventh National Symposium on Food Processing Wastes** Industrial Environmental Research Laboratory EPA Cincinnati, OH **ORDER FROM: NTIS-PB** 265 698 $12.75
600/2-77-005	SIC 322	**Source Assessment: Pressed and Blown Glass Manufacturing Plants** BY J. R. Schorr, D. T. Hooie, M.C. Brockway, P. R. Sticksel, and D. E. Niesz, Battelle Columbus Laboratories Columbus, OH **ORDER FROM:** Pending
600/2-77-023f	SIC 286	**Industrial Process Profiles for Environmental Use: Chapter 6. The Industrial Organic Chemicals Industry** BY R. Liepins, F. Mixon, C. Hudak, and T. Parsons, Research Triangle Institute Research Triangle Park, NC **ORDER FROM:** Pending
600/2-77-023g	SIC 286	**Industrial Process Profiles for Environmental Use: Chapter 7. Organic Dyes and Pigments Industry** BY T. R. Steadman, E. W. Helper, T. Parsons, G. E. Wilkins, and N. P. Phillips, Radian Corporation Austin, TX **ORDER FROM:** Pending
600/2-77-023i	SIC 282	**Industrial Process Profiles for Environmental Use: Chapter 9. The Synthetic Rubber Industry** BY J. Parr, T. B. Parsons, and N. P. Phillips, Radian Corporation Austin, TX **ORDER FROM:** Pending
600/2-77-023j	SIC 282	**Industrial Process Profiles for Environmental Use: Chapter 10. Plastics and Resins Industry** BY G. E. Wilkins, Radian Corporation Austin, TX **ORDER FROM:** Pending
600/2-77-023l	SIC 289	**Industrial Process Profiles for Environmental Use: Chapter 12. The Explosives Industry** BY C. E. Hudak, and T. B. Parsons, Radian Corporation Austin, TX **ORDER FROM:** Pending
600/2-77-023m	SIC 286	**Industrial Process Profiles for Environmental Use: Chapter 13. Plasticizers Industry** BY C. M. Thompson, Radian Corporation Austin, TX **ORDER FROM:** Pending
600/2-77-023o	SIC 281	**Industrial Process Profiles for Environmental Use: Chapter 15. Brine and Evaporite Chemicals Industry** BY P. E. Muehlberg, B. P. Shepherd, J. T. Redding, H. C. Behrens, and T. Parsons, Radian Corporation Austin, TX **ORDER FROM:** Pending
600/2-77-023p	SIC 282	**Industrial Process Profiles for Environmental Use: Chapter 16. The Fluorocarbon-Hydrogen Fluoride Industry** BY H. E. Doorenbus, and T. Parsons, Radian Corporation Austin, TX **ORDER FROM:** Pending
600/2-77-023q	SIC 327	**Industrial Process Profiles for Environmental Use: Chapter 17. The Gypsum and Wallboard Industry** BY T. Parsons, Radian Corporation Austin, TX **ORDER FROM:** Pending
600/2-77-023r	SIC 327	**Industrial Process Profiles for Environmental Use: Chapter 18. The Lime Industry** BY T. Parsons, and G. E. Wilkins, Radian Corporation Austin, TX **ORDER FROM:** Pending
600/2-77-023s	SIC 325	**Industrial Process Profiles for Environmental Use: Chapter 19. The Clay Industry** BY T. Parsons, and G. E. Wilkins, Radian Corporation Austin, TX **ORDER FROM:** Pending
600/2-77-023t	SIC 329	**Industrial Process Profiles for Environmental Use: Chapter 20. The Mica Industry** BY T. Parsons, and G. E. Wilkins, Radian Corporation Austin, TX **ORDER FROM:** Pending
600/2-77-023u	SIC 324	**Industrial Process Profiles for Environmental Use: Chapter 21. The Cement Industry** BY J. T. Reding, P. E. Muehlberg, B. P. Shepherd, T. Parsons, and G. E. Wilkins, Radian Corporation Austin, TX **ORDER FROM:** Pending
600/2-77-023w	SIC 281	**Industrial Process Profiles for Environmental Use: Chapter 23. Sulfur, Sulfur Oxides and Sulfuric Acid** BY R. W. Gerstle, V. S. Katari, T. Parsons, and C. Hudak, Radian Corporation Austin, TX **ORDER FROM:** Pending
600/2-77-023y	SIC 333	**Industrial Process Profiles for Environmental Use: Chapter 25. Primary Aluminum Industry** BY T. Parsons, Radian Corporation Austin, TX **ORDER FROM:** Pending

BIBLIOGRAPHIC SECTION

REPORT NO.		
600/2-77-023z	SIC 333	**Industrial Process Profiles for Environmental Use: Chapter 26. Titanium Industry** BY V. S. Katari, T. W. Devitt, and T. B. Parsons, Radian Corporation Austin, TX **ORDER FROM:** Pending
600/2-77-034	SIC 311	**Leather Tannery Waste Management Through Process Change, Reuse and Pretreatment** BY J. M. Constantin, and G. B. Stockman, Pfister and Vogel Tanning Company Milwaukee, WI **ORDER FROM: NTIS-PB** 264 204/AS $7.50
600/2-77-038	SIC 347	**Zinc Sludge Recycling After Kastone-R Treatment of Cyanide-Bearing Rinse Water** BY J. G. Moser, Metal Plating Corporation Connersville, IN **ORDER FROM:** Pending
600/2-77-039	SIC 347	**Reverse Osmosis Field Test: Treatment of Watts Nickel Rinse Waters** BY J. K. McNulty, R. L. Goldsmith, and A. Z. Gollan, Abcor, Inc., Walden Research Division Wilmington, MA **ORDER FROM:** Pending
600/2-77-048	SIC 208	**State of the Art: Wastewater Management in the Beverage Industry** BY M. E. Joyce, J. F. Scaief, M. W. Cochrane, and K. A. Dostal, Industrial Environmental Research Laboratory, EPA Corvallis, OR **ORDER FROM:** Pending
600/2-77-049	SIC 347	**Treatment of Metal Finishing Wastes by Sulfide Precipitation** BY R. M. Schlauch, and A. C. Epstein, Permutit Company Princeton, NJ **ORDER FROM:** Pending
600/2-77-059	SIC 329	**Evaluation of Electron Microscopy for Process Control in the Asbestos Industry** BY R. M. Gerber, and R. C. Rossi, Aerospace Corporation Los Angeles, CA **ORDER FROM:** Pending
600/2-77-072	SIC 347	**Foam Flotation Treatment of Heavy Metals and Fluoride-Bearing Industrial Wastewaters** BY D. J. Wilson, Vanderbilt University Nashville, TN **ORDER FROM:** Pending
600/3-76-111	SIC 261	**Design Considerations for Pulp and Paper-Mill Sludge Landfills** BY R. H. Ledbetter, U.S. Army Engineer Waterways Experimentation Station Vicksburg, MS **ORDER FROM: NTIS-PB** 264 032 $6.75
600/6-75-001	SIC 286	**Scientific and Technical Assessment Report on Particulate Polycyclic Organic Matter (PPOM)** Special Studies Staff, EPA Research Triangle Park, NC **ORDER FROM: NTIS-PB** 241 799 $4.75
600/6-75-003	SIC 200	**Scientific and Technical Assessment Report on Cadmium** Special Studies Staff, EPA Research Triangle Park, NC **ORDER FROM: NTIS-PB** 246 820/AS $4.50
600/6-75-004	SIC 282	**Scientific and Technical Assessment Report on Vinyl Chloride and Polyvinyl Chloride** Special Studies Staff, EPA Research Triangle Park, NC **ORDER FROM: NTIS-PB** 249 461/AS $5.50
600/7-76-034a	SIC 001	**Environmental Consideration of Selected Energy Conserving Manufacturing Process Options. Vol. I. Industry Summary Report** Arthur D. Little, Inc. Cambridge, MA **ORDER FROM: NTIS-PB** 262 977
600/7-76-034b	SIC 001	**Environmental Considerations of Selected Energy Conserving Manufacturing Process Options. Vol. II. Industry Priority Report** Arthur D. Little, Inc. Cambridge, MA **ORDER FROM: NTIS-PB** 264 268 $6.00
600/7-76-034e	SIC 261	**Environmental Considerations of Selected Energy Conserving Manufacturing Process Options. Vol. V. Pulp and Paper Industry Report** Arthur D. Little, Inc. Cambridge, MA **ORDER FROM: NTIS-PB** 264 271 $7.75
600/7-76-034f	SIC 286	**Environmental Considerations of Selected Energy Conserving Manufacturing Process Options. Vol. VI. Olefins Industry Report** Arthur D. Little, Inc. Cambridge, MA **ORDER FROM: NTIS-PB** 264 272 $6.75
600/7-76-034h	SIC 333	**Environmental Considerations of Selected Energy Conserving Manufacturing Process Options. Vol. VIII. Alumina/Aluminum Industry Report** Arthur D. Little, Inc. Cambridge, MA **ORDER FROM: NTIS-PB** 264 274 $6.75
600/7-76-034j	SIC 324	**Environmental Considerations fo Selected Energy Conserving Manufacturing Process Options. Vol. X. Cement Industry Report** Arthur D. Little, Inc. Cambridge, MA **ORDER FROM:** Pending
600/7-76-034k	SIC 321	**Environmental Considerations of Selected Energy Conserving Manufacturing Process Options. Vol. XI. Glass Industry Report** Arthur D. Little, Inc. Cambridge, MA **ORDER FROM:** Pending
600/7-76-034l	SIC 281	**Environmental Considerations of Selected Energy Conserving Manufacturing Process Options. Vol. XII. Chlor-Alkali Industry Report** Arthur D. Little, Inc. Cambridge, MA **ORDER FROM: NTIS-PB** 264 278 $5.00

BIBLIOGRAPHIC SECTION

REPORT NO.		
600/7-76-034m	SIC 281	**Environmental Considerations of Selected Energy Conserving Manufacturing Process Options. Vol. XIII. Phosphorus/ Phosphoric Acid Industry Report** Arthur D. Little, Inc. Cambridge, MA **ORDER FROM: NTIS-PB** 264 279 $5.00
600/7-76-034n	SIC 333	**Environmental Considerations of Selected Energy Conserving Manufacturing Process Options. Vol. XIV. Primary Copper Industry Report** Arthur D. Little, Inc Cambridge, MA **ORDER FROM: NTIS-PB** 264 280 $6.00
650/2-74-005	SIC 261	**Indigester Black Liquor Oxidation for Odor Control in Kraft Pulping** BY W. T. McKean, and J. S. Gratzl, North Carolina State University, Department of Wood and Paper Sciences Raleigh, NC **ORDER FROM: NTIS-PB** 228 692 $5.25
650/2-74-071a	SIC 261	**Improved Air Pollution Control for Kraft Recovery Boiler: Modified Recovery Boiler No. 3** Hoerner Waldorf Corporation St. Paul, MN **ORDER FROM: NTIS-PB** 237 627/AS $7.00
650/2-74-071b	SIC 261	**Improved Air Pollution Control for a Kraft Recovery Boiler: Recovery Boiler No.** 4 Hoerner Waldorf Corporation St. Paul, MN **ORDER FROM: NTIS-PB** 240 442/AS $4.75
650/2-74-084	SIC 286	**Odor Removal from Air by Adsorption on Charcoal** Kansas State University Manhattan, KS **ORDER FROM: NTIS-PB** 236 928/AS $5.25
650/2-74-085a	SIC 333	**Control of Sulfur Dioxide Emissions from Copper Smelters: Volume I – Steam Oxidation of Pyritic Copper Concentrates** Battelle Pacific Northwest Laboratories Richland, WA **ORDER FROM: NTIS-PB** 237 748/AS $4.75
650/2-74-085b	SIC 333	**Control of Sulfur Dioxide Emissions from Copper Smelters: Volume II – Hydrogen Sulfide Production from Copper Concentrates** Battelle Pacific Northwest Laboratories Richland, WA **ORDER FROM: NTIS-PB** 237 928/AS $5.25
650/2-74-087	SIC 329	**Identification and Assessment of Asbestos Emissions from Incidental Sources of Asbestos** Battelle Columbus Laboratories Columbus, OH **ORDER FROM: NTIS-PB** 241 999/AS $9.50
650/2-74-088	SIC 329	**Assessment of Particle Control Technology for Enclosed Asbestos Sources** IIT Research Institute Chicago, IL **ORDER FROM: NTIS-PB** 239 926/AS $5.75
650/2-74-090	SIC 329	**Characterization and Control of Asbestos Emissions from Open Sources** IIT Research Institute Chicago, IL **ORDER FROM: NTIS-PB** 238 925/AS $7.25
650/2-74-095	SIC 281	**Fluoride Emissions from Phosphoric Acid Plant Gypsum Ponds** North Carolina State University Raleigh, NC **ORDER FROM: NTIS-PB** 241 144/AS $9.50
650/2-74-097	SIC 282	**Vinyl Chloride – An Assessment of Emissions Control Techniques and Costs** BY B. H. Carpenter, Research Triangle Institute Research Triangle Park, NC **ORDER FROM: NTIS-PB** 237 343/AS $4.75
650/2-74-100	SIC 333	**Process Modifications for Control of Particulate Emissions from Stationary Combustion, Incineration, and Metals** Battelle Columbus Laboratories Columbus, OH **ORDER FROM: NTIS-PB** 237 422 $5.25
650/2-74-106	SIC 282	**System Analysis of Air Pollutant Emissions from the Chemical/ Plastics Industry** Foster D. Snell, Inc. Florham Park, NJ **ORDER FROM: NTIS-PB** 239 880/AS $8.75
650/2-74-107	SIC 282	**Characterization of Atmospheric Emissions from Polyurethane Resin Manufacture** Midwest Research Institute Kansas City, MO **ORDER FROM: NTIS-PB** 237 420/AS $4.75
650/2-74-111	SIC 333	**Measurement of Sulfur Dioxide, Particulate, and Trace Elements in Copper Smelter Converter and Roaster/Reverberatory Gas Streams** Research Triangle Institute Research Triangle Park, NC **ORDER FROM: NTIS-PB** 238 095/AS $4.75
650/2-74-115	SIC 333	**Trace Pollutant Emissions from the Processing of Metallic Ores** PEDCo-Environmental Specialists, Inc. Cincinnati, OH **ORDER FROM: NTIS-PB** 238 655/AS $8.75
650/2-74-122	SIC 324	**Trace Pollutant Emissions from the Processing of Non-Metallic Ores** PEDCo-Environmental Specialists, Inc. Cincinnati, OH **ORDER FROM: NTIS-PB** 240 117/AS $8.75
650/2-74-131	SIC 333	**Determination of Hazardous Elements in Smelter-Produced Sulfuric Acid** Monsanto Research Corporation Dayton, OH **ORDER FROM: NTIS-PB** 240 343/AS $4.25

BIBLIOGRAPHIC SECTION

REPORT NO.		
650/2-75-019a	SIC 347	**Source Assessment Prioritization of Air Pollution from Industrial Surface Coating Operations** Monsanto Research Corporation Dayton, OH **ORDER FROM: NTIS-PB** 243 423/AS $9.25
650/2-75-026a	SIC 284	**Testing of a Molecular Sieve Used to Control Mercury Emission From A Chlor-Alkali Plant, Volume I** Engineering Science, Inc. McLean, VA **ORDER FROM: NTIS-PB** 242 005 $4.25
650/2-75-026b	SIC 284	**Testing of a Molecular Sieve Used to Control Mercury Emission From A Chlor-Alkali Plant, Volume II – Appendices** Engineering Science, Inc. McLean, VA **ORDER FROM: NTIS-PB** 242 006 $7.50
650/2-75-032a	SIC 280	**Energy Consumption: The Chemical Industry** Dow Chemical Company Freeport, TX **ORDER FROM: NTIS-PB** 241 927/AS $4.25
650/2-75-032b	SIC 330	**Energy Consumption: The Primary Metals and Petroleum Industries** Dow Chemical Company Freeport, TX **ORDER FROM: NTIS-PB** 241 990 $4.50
650/2-75-032c	SIC 200	**Energy Consumption: Paper, Stone/Clay/Glass/Concrete, and Food Industries** Dow Chemical Company Freeport, TX **ORDER FROM: NTIS-PB** 241 926/AS $4.25
650/2-75-032d	SIC 001	**Energy Consumption: Fuel Utilization and Conservation in Industry** BY J. T. Reding, and B. P. Shepherd, Dow Chemical Company Freeport, TX **ORDER FROM: NTIS-PB** 246 888/AS $4.00
650/2-75-036	SIC 329	**Asbestos Fiber Atlas** California Department of Health Berkeley, CA **ORDER FROM: NTIS-PB** 244 766 $4.25
650/2-75-058a	SIC 329	**Johns-Manville CHEAF Evaluation** Air Pollution Technology, Inc. San Diego, CA **ORDER FROM: NTIS-PB** 256 311
660/2-73-010	SIC 261	**Treatment of Domestic Wastewater and NSSC Pulp and Paper Mill Wastes** BY P. J. Farrell, L. R. Heble, and A. G. Stenhser, Harriman Utility Board Harriman, TN **ORDER FROM: NTIS-PB** 231 267/AS
660/2-73-015	SIC 207	**Recovery of Fatty Materials From Edible Oil Refinery Effluents** BY W. C Seng, Swift and Company Oakbrook, IL **ORDER FROM: NTIS-PB** 231 268/AS
660/2-73-018	SIC 282	**Air Flotation – Biological Oxidation of Synthetic Rubber and Latex Wastewater** BY A. H. King, J. Ogea, and J. W. Sutton, Firestone Synthetic Rubber and Latex Company Lake Charles, Louisiana **ORDER FROM: NTIS-PB** 229 408
660/2-73-019	SIC 261	**Color Removal From Kraft Mill Effluents By Ultrafiltration** BY H. A. Fremount, D. C. Tate, and R. L. Goldsmith, U.S. Plywood-Champion Paper, Inc. Hamilton, OH **ORDER FROM: NTIS-PB** 231 257/AS
660/2-73-021	SIC 203	**Waste Control and Abatement in the Processing of Sweet Potatoes** BY C. Smallwood, North Carolina State University Raleigh, NC **ORDER FROM: NTIS-PB** 238 469
660/2-73-023	SIC 334	**Regeneration of Chromated Aluminum Deoxidizers** BY H. C. Hicks, and R. A. Jarmuth, Boeing Commercial Airplane Company Seattle, WA **ORDER FROM: NTIS-PB** 231 835/AS $6.25
660/2-73-024	SIC 333	**Treatment and Recovery of Fluoride Industrial Waste** BY C. J. Staebler Jr., Grumman Aerospace Corporation Bethpage, NY **ORDER FROM: NTIS-PB** 234 447
660/2-73-028	SIC 261	**Coliform Bacteria Growth and Control in Aerated Stabilization Basins** BY S. W. Watkins, Crown Zellerbach Corporation Camas, WA **ORDER FROM: NTIS-PB** 231 259/AS
660/2-73-030	SIC 261	**Treatment of Sulfite Evaporator Condensates for Recovery of Volatile Components** BY K. W. Baierl, N. L. Chang, B. F. Lueck, A. J. Wiley, and R. A. Holm, Institute of Paper Chemistry Appleton, WI **ORDER FROM: NTIS-PB** 233 139
660/2-73-031	SIC 200	**Proceedings Fourth National Symposium on Food Processing Wastes** Pacific Northwest Environmental Research Laboratory, EPA Corvallis, OR **ORDER FROM: NTIS-PB** 234 606
660/2-73-033	SIC 347	**New Membranes for Reverse Osmosis Treatment of Metal Finishing Effluents** BY L. T. Rozelle, C. V. Kopp Jr., and K. E. Cobian, North Star Research Corporation Minneapolis, MN **ORDER FROM: NTIS-PB** 240 722/AS $4.75
660/2-73-037	SIC 721	**Modular Wastewater Treatment System Demonstration for the Textile Maintenance Industry** BY G. Douglas, Envirex, Inc. Milwaukee, WI **ORDER FROM: NTIS-PB** 231 837

BIBLIOGRAPHIC SECTION

REPORT NO.		
660/2-74-006	SIC 203	**Wastewater Abatement in Canning Vegetables by IQB Blanching** BY D. B. Lund, Wisconsin, University of Madison, WI **ORDER FROM: NTIS-PB** 234 495
660/2-74-007	SIC 494	**Industrial Water Softener Waste Brine Reclamation** BY J. Burton, and E. Kreusch, Culligan International Company Northbrook, IL **ORDER FROM: NTIS-PB** 233 132
660/2-74-008	SIC 261	**Color Removal and Sludge Disposal Process for Kraft Mill Effluents** BY E. L. Spruill, Continental Can Company Hodge, LA **ORDER FROM: NTIS-PB** 235 573/AS
660/2-74-012	SIC 202	**Treatment of Cheese Processing Wastewaters in Aerated Lagoons** BY F. R. Dail, Kent Cheese Company Melrose Park, IL **ORDER FROM: NTIS-PB** 237 334/AS
660/2-74-014	SIC 208	**Activated Sludge – Bio-Disc Treatment of Distillery Wastewater** BY J. L. Thomas, and I. G. Koehren, Stanley Consultants, Inc. Muscatine, IA American Distilling Company Pekin, IL **ORDER FROM: NTIS-PB** 234 383
660/2-74-020	SIC 201	**Evaluation of Polymeric Clarification of Meat-Packing and Domestic Wastewaters** Metropolitan Sewer Board St. Paul, MN **ORDER FROM: NTIS-PB** 235 900/AS
660/2-74-025	SIC 202	**Protein Production from Acid Whey VIA Fermentation** BY S. Bernstein, and T. C. Everson, Milbrew, Inc. Juneau, WI **ORDER FROM: NTIS-PB** 235 504/AS
660/2-74-027	SIC 201	**Treatment of Packing House Waste by Anaerobic Lagoons in Plastic-Media Filters** BY D. A. Baker, A. H. Wymore, and J. E. White, Family and Foods, Inc. Denison, IA **ORDER FROM: NTIS-PB** 235 566/AS
660/2-74-028	SIC 206	**Biological Treatment of Concentrated Sugar Beet Wastes** BY J. H. Fisher, Beet Sugar Development Foundation Fort Collins, CO **ORDER FROM: NTIS-PB** 240 123/AS $4.75
660/2-74-029	SIC 261	**Color Characterization Before and After Lime Treatment** BY H. S. Dugal, R. M. Leekley, and J. W. Swanson, Institute of Paper Chemistry Appleton, WI **ORDER FROM: NTIS-PB** 235 493/AS
660/2-74-031	SIC 201	**Water and Waste Management in Poultry Processing** BY R. E. Carawan, J. Macon, and W. M. Crosswhite, North Carolina State University Raleigh, NC BY B. K. Hawkins, Gold Kist, Inc. Durham, NC **ORDER FROM: NTIS-PB** 235 559/AS $7.50
660/2-74-035	SIC 202	**Improvement of Treatment of Food Industry Waste** BY S. B. Tuwiner, RAI Research Corporation Houpage, Long Island, NY **ORDER FROM: NTIS-PB** 234 444
660/2-74-040	SIC 328	**Granite Industry Wastewater Treatment** BY W. B. Farnham, Vermont, State of, Department of Water Resources Montpelier, VT **ORDER FROM: NTIS-PB** 235 505
660/2-74-041	SIC 200	**Wastewater Use in the Production of Food and Fiber—Proceedings of a Conference Held at Oklahoma City, OK, March 5-7,1974** Robert S. Kerr Environmental Research Laboratory Ada, OK **ORDER FROM: NTIS-PB** 245 176 $13.25
660/2-74-044	SIC 261	**Test Method for Volatile Component Stripping of Wastewater** BY L. J. Thibodeaux, Arkansas, University of, College of Engineering Fayetteville, AR **ORDER FROM: NTIS-PB** 235 567/AS
660/2-74-046	SIC 201	**Paunch Manure as a Feed Supplement in Channel Catfish Farming** BY R. C. Summerfelt, Oklahoma State University Stillwater, OK S. C. Yin, Robert S. Kerr Environmental Research Laboratory, EPA Ada, OK **ORDER FROM: NTIS-PB** 235 575/AS
660/2-74-055	SIC 495	**Physical-Chemical Treatment of Municipal Wastes by Recycled Magnesium Carbonate** BY A. P. Black, A. T. DeBose, and R. P. Vogh, Gainesville, City of Gainesville, FL **ORDER FROM: NTIS-PB** 239 326/AS
660/2-74-058	SIC 200	**Proceedings: Fifth National Symposium on Food Processing Wastes** BY K. A. Dostal, Pacific Northwest Environmental Research Laboratory, EPA Corvallis, OR **ORDER FROM: NTIS-PB** 237 520/AS $6.30
660/2-74-059	SIC 208	**Submerged Combustion Evaporator for Concentration of Brewery Spent Grain Liquor** BY J. L. Stein, Anheuser Busch St. Louis, MO **ORDER FROM: NTIS-PB** 238 475/AS
660/2-74-060	SIC 201	**Poultry Processing Wastewater Treatment and Reuse** BY J. D. Clise, Maryland, State of, Department of Health and Mental Hygiene Baltimore, MD **ORDER FROM: NTIS-PB** 237 185/AS
660/2-74-061	SIC 209	**Shrimp Canning Waste Treatment Study** BY A. F. Mauldin, and A. J. Szabo, Dominque, Szabo and Associates, Inc. Lafayette, LA **ORDER FROM: NTIS-PB** 239 050/AS

BIBLIOGRAPHIC SECTION

REPORT NO.		
660/2-74-066	SIC 328	**State of the Art: Sand and Gravel Industry** BY B. D. Newport, and J. E. Moyer, Robert S. Kerr Environmental Research Laboratory Ada, OK **ORDER FROM: NTIS-PB** 236 147 $2.85
660/2-74-069	SIC 261	**Studies of Low Molecular Weight Lignin Sulfonates** BY W. G. Glasser, J. S. Gratzl, K. Forss, B. F. Hrutfiord, L. N. Johanson, J. L. McCarthy, and J. Collins, Washington, University of Seattle, WA **ORDER FROM: NTIS-PB** 239 368/AS
660/2-74-074	SIC 208	**Rum Distillery Slops Treatment by Anaerobic Contact Process** BY T. Shea, E. Ramos, J. Rodriguez, and G. Dorion, Bacardi Company San Juan, PR **ORDER FROM: NTIS-PB** 238 291/AS
660/2-74-075	SIC 203	**Wastewater Characterization for the Specialty Food Industry** BY C. J. Schmidt, J. Farquhar, and E. V. Clements, SCS Engineers Long Beach, CA **ORDER FROM: NTIS-PB** 239 968/AS $5.75
660/2-74-086	SIC 261	**Mercury Recovery from Contaminated Waste Waters and Sludges** Georgia Pacific Corporation Bellingham, WA **ORDER FROM: NTIS-PB** 238 600/AS
660/2-74-088	SIC 203	**Infrared Dry Caustic vs. Wet Caustic Peeling of White Potatoes** BY O. Sproul, J. Vennes, W. Knudson, and J. W. Cyr, Western Potato Service, Inc. Grand Forks, ND Potato Service, Inc. Presque Isle, ME **ORDER FROM: NTIS-PB** 244 408/AS $4.25
660/2-74-091	SIC 203	**Continuous Inplant Hot Gas Blanching of Vegetables** BY J. W. Ralls, and W. A. Mercer, National Canners Association Berkeley, CA **ORDER FROM: NTIS-PB** 238 601/AS $5.50
660/2-74-092	SIC 203	**Dry Caustic Peeling of Clingstone Peaches on a Commercial Scale** BY H. E. Stone, DelMonte Corporation San Francisco, CA **ORDER FROM: NTIS-PB** 239 751/AS $4.25
660/2-74-093	SIC 206	**Separation, Dewatering, and Disposal of Sugar Beet Transport Water Solids Phase I** BY I. V. Fordyce, and A. M. Cooley, American Crystal Sugar Company Denver, CO **ORDER FROM: NTIS-PB** 239 200/AS
660/2-75-001	SIC 203	**Waste Citrus Activated Sludge As a Poultry Feed Ingredient** BY R. H. Jones, J. T. White, and B. L. Damron, Winter Garden Citrus Products Cooperative Winter Garden, FL **ORDER FROM: NTIS-PB** 240 672/AS $4.25
660/2-75-002	SIC 208	**Pilot Scale Treatment of Wine Stillage** BY E. D. Schroeder, California, University of Davis, CA **ORDER FROM: NTIS-PB** 240 996/AS $5.75
660/2-75-004	SIC 261	**Activated Carbon Treatment of Unbleached Kraft Effluent for Reuse** BY E. W. Lang, W. G. Timpe, and R. L. Miller, St. Regis Paper Company Pensacola, FL **ORDER FROM: NTIS-PB** 243 246/AS $7.25
660/2-75-006	SIC 494	**Plant Scale Studies of the Magnesium Carbonate Water Treatment Process** BY A. P. Black, and C. G. Thompson, Black, Crow and Eidsness, Inc. Montgomery, AL **ORDER FROM: NTIS-PB** 242 253/AS $6.25
660/2-75-017	SIC 286	**Radiation Treatment of High Strength Chlorinated Hydrocarbon Wastes** BY T. F. Craft, R. D. Kimbrough, and C. T. Brown, Georgia Institute of Technology Atlanta, GA **ORDER FROM: NTIS-PB** 244 388/AS $3.75
660/2-75-019	SIC 201	**Egg Breaking and Processing Waste Control and Treatment** BY W. J. Jewell, H. R. Davis, O. F. Johndrew Jr., R. C. Loehr, W. Siderewicz, and R. R. Zall, Cornell University Ithaca, NY **ORDER FROM: NTIS-PB** 245 588/AS $7.00
660/2-75-021	SIC 286	**Optimizing a Petrochemical Waste Bio-Oxidation System Through Automation** BY M. A. Zeitoun, W. F. McIlheny, N. J. Riscan, J. H. Culp, and H. C. Behrens, Dow Chemical Company Freeport, TX **ORDER FROM: NTIS-PB** 247 160 $7.75
660/2-75-024	SIC 263	**Taxonomy of Klebsiella pneumoniae Isolated From Pulp/Paper Mill Wastewater** BY M. D. Knittel, Pacific Northwest Environmental Research Laboratory, EPA Corvallis, OR **ORDER FROM: NTIS-PB** 244 405/AS $3.75
660/2-75-028	SIC 261	**Organic Compounds in Pulp Mill Lagoon Discharge** BY B. F. Hrutfiord, T. S. Friberg, D. F. Wilson, and J. R. Wilson, Washington, University of Seattle, WA **ORDER FROM: NTIS-PB** 246 900/AS $4.50
660/4-75-005	SIC 261	**Analysis of Organic Compounds in Two Kraft Mill Wastewaters** BY L. W. Keith, Southeast Environmental Research Laboratory Athens, GA **ORDER FROM: NTIS-PB** 247 698 $5.50
670/2-73-005	SIC 242	**Utilization of Bark Wastes** BY R. A. Currier, and M. L. Lauer, Oregon State University Corvallis, OR **ORDER FROM: NTIS-PB** 221 876 $7.00

BIBLIOGRAPHIC SECTION

REPORT NO.		
670/2-74-008	SIC 334	**Metallic Recovery From Waste Waters Utilizing Cementation** BY O. P. Case, Anaconda American Brass Company Waterbury, CT **ORDER FROM: NTIS-PB 233 143**
670/2-74-030	SIC 285	**Waterborne Wastes of the Paint and Inorganic Pigments Industries** BY J. J. Barrett, G. A. Mornea, and J. J. Roden III, Southern Research Institute Birmingham, AL **ORDER FROM: NTIS-PB 232 019/AS $4.00**
670/2-74-042	SIC 347	**Waste Water Treatment and Reuse in a Metal Finishing Job Shop** S.K. Williams Company Wauwatosa, WI **ORDER FROM: NTIS-PB 234 476/AS $3.75**
670/2-74-044	SIC 285	**Ion Exchange Process for Recovery of Chromate from Pigment Manufacturing** BY D. Robinson, H. Weisberg, G. Chase, K. Libby Jr., and J. Capper, Mineral Pigments, Corporation Beltsville, MD **ORDER FROM: NTIS-PB 233 641/AS $4.50**
670/2-74-057	SIC 283	**Characterization of Waste Waters from the Ethical Pharmaceutical Industry** BY J. Mayes, Gulf Southern Research Institute for Pharmaceutical Associates Washington, DC **ORDER FROM: NTIS-PB 233 116**
670/2-74-059	SIC 347	**Laboratory Study of Continous Electro-oxidation of Dilute Cyanide Waste** BY J. J. Byerley, and K. Enns, Waterloo, University of, Department of Chemical Engineering Waterloo, Ontario, Canada **ORDER FROM: NTIS-PB 235 588/AS $3.25**
670/2-75-015	SIC 289	**Pilot Plant Optimization of Phosphoric Acid Recovery Process** BY L. E. Lancy, F. A. Steward, and J. H. West, Lancy Laboratories Zelienople, PA **ORDER FROM: NTIS-PB 241 793/AS $3.75**
670/2-75-016	SIC 333	**Reclamation of Sulfuric Acid From Waste Streams** BY H. C. Peterson, and P. L. Kern, New Jersey Zinc Company Palmerton, PA **ORDER FROM: NTIS-PB 241 791/AS $4.25**
670/2-75-018	SIC 347	**Reclamation of Metal Values from Metal-Finishing Waste Treatment Sludges** BY A. B. Tripler Jr., R. H. Cherry Jr., and G. R. Smithson Jr., Battelle Columbus Laboratories Columbus, OH **ORDER FROM: NTIS-PB 242 018/AS $4.75**
670/2-75-029	SIC 335	**Copper Recovery from Brass Mill Discharge by Cementation with Scrap Iron** BY P. O. Case, Anaconda Company Waterbury, CT **ORDER FROM: NTIS-PB 241 822/AS $4.25**
670/2-75-043	SIC 324	**Disposal and Utilization of Waste Kiln Dust From Cement Industry** BY T. A. Davis, and D. B. Hooks, Southern Research Institute Birmingham, AL **ORDER FROM: NTIS-PB 242 825/AS $4.25**
670/2-75-055	SIC 347	**Removal of Chromium from Plating Rinse Water Using Activated Carbon** BY R. B. Landrigan, and J. B. Hallowell, Battelle Columbus Laboratories Columbus, OH **ORDER FROM: NTIS-PB 243 370/AS $4.25**

REPORT ABSTRACTS SECTION

600/2-75-001 SIC 001 ALL INDUSTRY IN-HOUSE PROJECT

Projects in the Industrial Pollution Control Division – December 1974 Industrial Pollution Control Division, EPA Washington, DC **ORDER FROM: NTIS-PB** 243 892/AS $11.25

The document is a compilation of information sheets from industrial pollution control projects initiated since fiscal year 1967 through fiscal year 1974. Each sheet contains the objectives, statistical information, and a brief description of the particular project. General introductory information on the Federal industrial pollution control program is also presented to provide perspective on the magnitude of industrial pollution and the research directions that must be pursued in order to develop the technology to adequately control this largest point source of pollution in the United States.

600/7-76-034a SIC 001 ALL INDUSTRY CONTRACT NO. 68-03-2198

Environmental Consideration of Selected Energy Conserving Manufacturing Process Options. Vol. I. Industry Summary Report Arthur D. Little, Inc. Cambridge, MA **ORDER FROM: NTIS-PB** 262 977 EPA CONTACT: Skovronek, H. S. 8-340-6681

600/7-76-034b SIC 001 ALL INDUSTRY CONTRACT NO. 68-03-2198

Environmental Considerations of Selected Energy Conserving Manufacturing Process Options. Vol. II. Industry Priority Report Arthur D. Little, Inc. Cambridge, MA **ORDER FROM: NTIS-PB** 264 268 $6.00 EPA CONTACT: Skovronek, H. S.

650/2-75-032d SIC 001 ALL INDUSTRY CONTRACT NO. 68-02-1329

Energy Consumption: Fuel Utilization and Conservation in Industry BY J. T. Reding, and B. P. Shepherd, Dow Chemical Company Freeport, TX **ORDER FROM: NTIS-PB** 246 888/AS $4.00

The report gives results of a study of fuel utilization and energy conservation for the six biggest energy consuming industrial groups: chemicals, primary metals, petroleum, paper, stone/clay/glass/concrete and food. Level of heat rejection and short term effects of various conservation measures are covered. EPA CONTACT: Tucker, W. G.

600/1-75-005 SIC 286 CHEMICALS CONTRACT NO. 68-02-0542

Vapor-Phase Organic Pollutants – Volatile Hydrocarbons and Oxidation Products National Academy of Sciences Washington, DC **ORDER FROM: NTIS-PB** 249 357/AS $16.25

This report concerns vapor-phase substances likely to be produced as community pollutants in sufficient amounts to affect health and well-being. Sources of vapor-phase organic pollutants are listed, including collection and sampling techniques and analytical methods. Possible mechanisms of formation of oxygenated organic hydrocarbon compounds in the atmosphere and of atmospheric reactions of oxides of nitrogen and sulfur are studied. Toxicologic, pathophysiologic, and epidemiologic information on vapor-phase organic pollutants is reviewed, their metabolism, and their effects on the total environment. Special attention is given to oxidized compounds, formaldehyde, ozone, and benzene. The report stresses the importance of oxidation reactions in the vapor-phase and the human health hazards produced from the more or less transient products of oxidation. The review of metabolism indicates that, although vapor-phase hydrocarbon pollutants are modified usually by enzymatic oxidation within mammalian systems from nonpolar to polar compounds (which are then excreted by the kidney), this sometimes occurs with the production of toxic intermediates. These reactions occur mostly in the liver and to a lesser extent in the kidney, intestine, and lung. EPA CONTACT: Hueter, F. G.

600/2-74-009b SIC 289 CHEMICALS GRANT NO. 800857

State-of-The-Art For The Inorganic Chemicals Industry: Commercial Explosives BY J. Patterson, Illinois Institute of Technology Chicago, IL **ORDER FROM: NTIS-PB** 240 960 $4.75

A literature and field study of the commercial explosives industry reveals that on the basis of products manufactured, plant size, and the nature of the wastewater, the industry may be divided into three segments. One complex facilities, are large plants manufacturing a variety of explosives and intermediate products. The second category is small specialized formulation plants, typically limited to blending explosives formulations for use in nearby mining activities. The final category is specialty product facilities, devoted to manufacture of select ingredients such as lead aside and other explosives initiators, blasting caps, electric matches and similar appurtenance items. Industrial processes, water pollution and abatement technology for these various plants and products are also surveyed. EPA CONTACT: Des Rosiers, P.

REPORT ABSTRACTS SECTION

600/2-74-009c **SIC 281 CHEMICALS** **GRANT NO. 800857**

State-of-The-Art For The Inorganic Chemicals Industry: Industrial Inorganic Gases BY J. Patterson, Illinois Institute of Technology Chicago, IL **ORDER FROM: NTIS-PB** 240 961/AS $4.25

A literature and field study of the inorganic gas industry revealed that the industry is dominated by (1) air separation plants producing argon, nitrogen and/or oxygen, (2) hydrogen plants and (3) carbon dioxide plants. The major effluent of the industry is cooling water, which may be contaminated with raw product condensates, oil and grease, and water supply and cooling water treatment chemicals. Spent scrubber solution from product purification may also constitute a significant waste, although newer production technology eliminates this aspect, as well as oil and grease. Control and abatement strategies are briefly discussed. EPA CONTACT: Des Rosiers, P.

600/2-75-066 **SIC 281 CHEMICALS** **CONTRACT NO. 68-02-1323**

Molecular Sieve Control Process in Sulfuric Acid Plants BY D. W. Hissong, Battelle Columbus Laboratories Columbus, OH **ORDER FROM: NTIS-PB** 249 563/AS $5.00

The report gives results of an engineering analysis of the applicability of molecular sieve technology to the control of SO_2 emissions from sulfuric acid plants. After the equivalent of 10 months of operation, one plant using this technology is still controlling SO_2 emissions to well within Federal and State regulations for sulfuric acid plants. It is also meeting the performance guarantee of the process developer and vendor. Although the concept of a 2-year sieve life with acceptable SO_2 control has not been demonstrated, there is no reason to believe that it cannot be achieved. at this point this application of molecular sieve technology appears technically feasible. The economic feasibility of the technology for this application was assessed by comparing its total capitalized cost (including investment and operating cost) with that of the Wellman-Lord and dual absorption processes. Capitalized costs for the three are fairly close; individual plant characteristics will affect the economic choice. The technology is more competitive for smaller plants and for those which already have sieve-regeneration air driers. Although the dual absorption process will be the least expensive for many plants, it is limited in its effectiveness. Considering overall cost and effectiveness, molecular sieve technology appears to be economically feasible for some acid plants. EPA CONTACT: Wooldridge, E. J.

600/2-76-010 **SIC 281 CHEMICALS** **CONTRACT NO. 68-02-1322**

Sulfuric Acid Plant Emissions During Start-up, Shutdown, and Malfunction BY E. L. Calvin, and F. D. Kodras, Catalytic, Inc. Charlotte, NC **ORDER FROM: NTIS-PB** 249 508/AS $10.50

The report gives results of a study of dual-absorption contact sulfuric acid plants, as well as single-absorption plants equipped with vent gas cleaning systems for removal of SO_2, to determine the relationship between process parameters and air emissions. Processes studied were dual-absorption acid plants and single-absorption acid plants equipped with sodium scrubbers, ammonia scrubbers, and molecular sieve adsorbers. Emissions considered were SO_2 and acid mist emissions and vent gas opacity. Relationships were developed for normal operations and compared to off-normal operations such as shutdown, start-up, malfunction, and misoperation. Process parameters and emission relationships are presented in statistical, tabular, and graphic form. Converter bed operating temperature ranges were established and causes of SO_2 and acid mist emissions are illustrated from plant operating data. EPA CONTACT: Hendriks, R. V.

600/2-76-014 **SIC 281 CHEMICALS** **CONTRACT NO. 68-02-1323**

Molecular Sieve Mercury Control Process in Chlor-Alkali Plants BY M. Y. Anastas, Battelle Columbus Laboratories Columbus, OH **ORDER FROM: NTIS-PB** 251 203/AS $4.50

The report gives results of an investigation of the use of the PuraSiv Hg adsorption process to remove mercury from the hydrogen byproduct stream and the end-box ventilation stream from mercury cell chlor-alkali plants. The investigation included the analysis of data obtained from testing of a system that is currently in operation and technical information provided by the system vendor together with that available in the open literature. Although the measurements of mercury concentration in the hydrogen byproduct stream entering the PuraSiv Hg adsorber, taken during performance testing of the control unit, appear to be in error, measurements of the outlet concentration indicate that a concentration less than 60 ppbv may be achieved. The economics of the PuraSiv Hg adsorption process were explored. Available data indicate that the operating costs by this process vary between $0.58 and $0.33 per ton of chlorine produced for plants with capacities between 100 and 750 tons per day. Mercury may also be removed from the hydrogen byproduct stream either by brine adsorption over treated activated carbon or by scrubbing with depleted brine. Technical and economic data available to the investigator seem to favor the use of these two processes for mercury control, although the data base thereon is not sufficiently developed to warrant a meaningful comparison. EPA CONTACT: Wooldridge, E. J.

REPORT ABSTRACTS SECTION

600/2-76-017 SIC 281 CHEMICALS GRANT NO. 802752

Renovation of Industrial Inorganic Wastewater by Evaporation with Interface Enhancement BY H. H. Sephton, California, University of, Sea Water Conversion Laboratory Richmond, CA **ORDER FROM: NTIS-PB** 252 025/AS $4.50

A novel method of vertical tube evaporation (VTE) to improve heat transfer performance was applied to the concentration of three types of industrial wastewaters. This method, interface enhancement, relies upon the addition of a few parts per million of a selected surfactant to the wastewater feed followed by imposed two-phase foamy liquid-vapor flow over the heat transfer surfaces. Applied to the concentration of power plant cooling tower blowdown and boiler blowdown, interface-enhanced VTE provided an approximate 120 percent increase in the usual VTE heat transfer performance, using a 5,000 gpd pilot plant having double-fluted aluminum-brass distillation tubes, under process conditions that are realistic for large industrial plants. Acidic mine drainage water, concentrated by double-fluted titanium evaporator tubes provided about a 60 percent heat transfer performance enhancement. Beneficial side effects of the surfactant additive were to inhibit the crystallization of solutes, permitting concentration of the wastewaters to smaller volumes. This work indicates feasibility and improved economics for renovation-recycle of each of the three types of wastewater examined. EPA CONTACT: Freeman, H.

600/2-76-032d SIC 286 CHEMICALS CONTRACT NO. 68-02-1874

Source Assessment: Phthalic Anhydride BY R. W. Serth, and T. W. Hughes, Monsanto Research Corporation Dayton, OH **ORDER FROM: NTIS-PB** 256 310 EPA CONTACT: Denny, D. A.

600/2-76-047 SIC 281 CHEMICALS CONTRACT NO. 68-02-1401

Molecular Sieve Tests for Control of Sulfuric Acid Plant Emissions BY K. R. Boldt, and R. F. Timmons, York Research Corporation Stamford, CT **ORDER FROM: NTIS-PB** 258 676 EPA CONTACT: Wooldridge, E. J.

600/2-76-051b SIC 286 CHEMICALS CONTRACT NO. 68-02-1319

Environmental Catalog of Industrial Processes; Volume II— Industrial Organic Chemicals BY T. Parsons, Radian Corporation Austin, TX **ORDER FROM:** Pending EPA CONTACT: Tucker, G.

600/2-76-053 SIC 286 CHEMICALS CONTRACT NO. 68-02-1835

Hydrocarbon Emissions Reduction From Ethylene Dichloride Processes BY W. S. Amato, B. Bandyopadhyay, B. E. Kurtz, and R. H. Fitch, Allied Chemical Corporation Solvay, NY **ORDER FROM: NTIS-PB** 255 837

The report gives results of the initial phase of the development of a low-emissions ethylene oxhydrochlorination process for producing 1,2-dichloroethane (ethylene dichloride). First, experimental work on an existing pilot-plant-scale, once-through process was used both to obtain baseline emission data in mass of hydrocarbon (HC) plus ethylene dichloride (EDC) per mass of HCl fed as a function of reactor temperature and percent excess ethylene to the reactor, and to resolve potential problems which may arise in a recycle operation. Second, the existing once-through pilot plant was converted to a recycle operation which then functioned successfully and yielded emission data in mass of HC plus EDC per mass of HCl fed as a function of reactor temperature and percent excess ethylene to the reactor. In particular, the project objective of reducing by 90% the HC plus EDC emissions from an ethylene oxyhydrochlorination process, through recycling of reactor off-gases, was positively demonstrated. Third, various operating difficulties were assessed which would be important for future control applications and scale-up efforts. Economic analyses are presented to demonstrate the competitive position of the improved process. EPA CONTACT: Baker, K.

600/2-76-119 SIC 281 CHEMICALS CONTRACT NO. 68-02-1322

Effect of Equipment Maintenance and Age on Sulfuric Acid Plant Emissions BY E. L. Calvin, and F. D. Kodras, Catalytic, Inc. Charlotte, NC **ORDER FROM: NTIS-PB** 253 947/AS $5.00 EPA CONTACT: Hendricks, R. V.

600/2-76-122 SIC 286 CHEMICALS CONTRACT NO. 68-02-1411

Technical Manual for Process Sampling Strategies for Organic Materials BY W. Feairheller, P. J Marn, D. H. Harris, and D. L. Harris, Monsanto Research Corporation Dayton, OH **ORDER FROM: NTIS-PB** 256 696 EPA CONTACT: Johnson, L. D.

600/2-76-123 SIC 286 CHEMICALS GRANT NO. 12020 EGC

Treatment and Disposal of Complex Industrial Wastes BY C. Schimmel, and D. Griffin, Reichhold Chemicals, Inc. Tuscaloosa, AL **ORDER FROM: NTIS-PB** 262 979 EPA CONTACT: Lomasney, E. P.

REPORT ABSTRACTS SECTION

600/2-76-195 SIC 286 CHEMICALS GRANT NO. 12020 FOH

Evaluation and Upgrading of a Multi-Stage Trickling Filter Facility BY J. H. Koon, R. F. Curran, C. E. Adams Jr., and W. W. Eckenfelder Jr., AWARE, Inc. Nashville, TN **ORDER FROM:** NTIS-PB 265 471 $6.75 EPA CONTACT: Stonefield, D. H.

600/2-76-211 SIC 281 CHEMICALS CONTRACT NO. 68-02-2220

Construction of a Prototype Sulfuric Acid Mist Monitor BY W. S. Eaton, and D. L. Strehler, Rockwell International Corporation Newbury Park, CA **ORDER FROM:** NTIS-PB 265 613 $4.50 EPA CONTACT: Cheney, J. L.

600/2-76-213a SIC 289 CHEMICALS GRANT NO. 802872

State-of-the-Art: Military Explosives and Propellants Production Industry. Volume I – The Military Explosives and Propellants Industry BY J. Patterson, J. Brown, W. Duckert, J. Polson, and N. I. Shapira, American Defense Preparedness Association Washington, DC **ORDER FROM:** NTIS-PB 265 385 $5.50 EPA CONTACT: Skovronek, H.

600/2-76-213b SIC 289 CHEMICALS GRANT NO. 802872

State-of-the-Art: Military Explosives and Propellants Production Industry. Volume II – Wastewater Characterization BY J. Patterson, J. Brown, W. Duckert, J. Polson, and N. I. Shapira, American Defense Preparedness Association Washington, DC **ORDER FROM:** NTIS-PB 260 918 EPA CONTACT: Skovronek, H.

600/2-76-213c SIC 289 CHEMICALS GRANT NO. 802872

State of-the-Art: Military Explosives and Propellants Production Industry. Volume III – Wastewater Treatment BY J. Patterson, J. Brown, W. Duckert, J. Polson, and N. I. Shapira, American Defense Preparedness Association Washington, DC **ORDER FROM:** NTIS-PB 265 042 $7.50 EPA CONTACT: Skovronek, H.

600/2-76-223 SIC 281 CHEMICALS GRANT NO. 12020 EMI

Dialysis for Concentration and Removal of Industrial Wastes BY J. K. Smith, S. V. Desai, R. E. C. Weaver, and E. Klein, Gulf South REsearch Institute New Orleans, LA **ORDER FROM:** NTIS-PB 265 572 $5.00 EPA CONTACT: Mayhue, L. F.

600/2-76-227 SIC 289 CHEMICALS GRANT NO. 801431

Naval Stores Wastewater Pruification and Reuse by Activated Carbon Treatment BY F. H. Gardner Jr., and A. R. Williamson, Hercules, Inc. Hattiesburg, MS **ORDER FROM:** NTIS-PB 261 168 EPA CONTACT: Skovronek, H. S.

600/2-76-270 SIC 286 CHEMICALS CONTRACT NO. 68-03-0456

Converting Chlorohydrocarbon Wastes by Chlorolysis BY J. K. Shiver, Repro Chemical Corporation Washington, DC **ORDER FROM:** NTIS-PB 259 935/as $4.50

The report gives results of an assessment of the magnitude of the waste chlorohydrocarbon problem in the U.S., and a study of the applicability of the conversion of this waste by chlorolysis as a means of resolving the problem. An estimated 86,400 metric tons per year of chlorohydrocarbon waste is generated in the U.S. A portion of this waste is treated by chlorolysis to solvents, and by incineration. The balance is disposed of by deep well injection or burial. The identified waste is a suitable feed-stock for a chlorolysis operation if it is pretreated to remove particulate materials and moisture. Geographically, the waste is generated primarily along the Gulf Coast, from Corpus Christi to New Orleans. The Gulf Coast concentration indicates that a regional waste disposal facility (including a chlorolysis unit, a waste pretreatment unit, and a conventional incineration unit) would be viable. Preparation of a design and firm capital estimate is recommended as the next step in an overall program leading to such a regional facility. EPA CONTACT: Samfield, M.

600/2-77-023f SIC 286 CHEMICALS CONTRACT NO. 68-02-1325

Industrial Process Profiles for Environmental Use: Chapter 6. The Industrial Organic Chemicals Industry BY R. Liepins, F. Mixon, C. Hudak, and T. Parsons, Research Triangle Institute Research Triangle Park, NC **ORDER FROM:** Pending EPA CONTACT: Harrington, R. E.

REPORT ABSTRACTS SECTION

600/2-77-022g SIC 286 CHEMICALS CONTRACT NO. 68-02-1319

Industrial Process Profiles for Environmental Use: Chapter 7. Organic Dyes and Pigments Industry BY T. R. Steadman, E. W. Helper, T. Parsons, G. E. Wilkins, and N. P. Phillips, Radian Corporation Austin, TX **ORDER FROM:** Pending EPA CONTACT: Harrington, R. E.

600/2-77-022i SIC 282 CHEMICALS CONTRACT NO. 68-02-1319

Industrial Process Profiles for Environmental Use: Chapter 9. The Synthetic Rubber Industry BY J. Parr, T. B. Parsons, and N. P. Phillips, Radian Corporation Austin, TX **ORDER FROM:** Pending EPA CONTACT: Harrington, R. E.

600/2-77-022j SIC 282 CHEMICALS CONTRACT NO. 68-02-1319

Industrial Process Profiles for Environmental Use: Chapter 10. Plastics and Resins Industry BY G. E. Wilkins, Radian Corporation Austin, TX **ORDER FROM:** Pending EPA CONTACT: Harrington, R. E.

600/2-77-023l SIC 289 CHEMICALS CONTRACT NO. 68-02-1319

Industrial Process Profiles for Environmental Use: Chapter 12. The Explosives Industry BY C. E. Hudak, and T. B. Parsons, Radian Corporation Austin, TX **ORDER FROM:** Pending EPA CONTACT: Harrington, R. E.

600/2-77-[illegible]23m SIC 286 CHEMICALS CONTRACT NO. 68-02-1319

Industrial Process Profiles for Environmental Use: Chapter 13. Plasticizers Industry BY C. M. Thompson, Radian Corporation Austin, TX **ORDER FROM:** Pending EPA CONTACT: Harrington, R. E.

600/2-77-023o SIC 281 CHEMICALS CONTRACT NO. 68-02-1319

Industrial Process Profiles for Environmental Use: Chapter 15. Brine and Evaporite Chemicals Industry BY P. E. Muehlberg, B. P. Shepherd, J. T. Redding, H. C. Behrens, and T. Parsons, Radian Corporation Austin, TX **ORDER FROM:** Pending EPA CONTACT: Harrington, R. E.

600/2-77-023p SIC 282 CHEMICALS CONTRACT NO. 68-02-1319

Industrial Process Profiles for Environmental Use: Chapter 16. The Fluorocarbon-Hydrogen Floride Industry BY H. E. Doorenbus, and T. Parsons, Radian Corporation Austin, TX **ORDER FROM:** Pending EPA CONTACT: Harrington, R. E.

600/2-77-023w SIC 281 CHEMICALS CONTRACT NO. 68-02-1319

Industrial Process Profiles for Environmental Use: Chapter 23. Sulfur, Sulfur Oxides and Sulfuric Acid BY R. W. Gerstle, V. S. Katari, T. Parsons, and C. Hudak, Radian Corporation Austin, TX **ORDER FROM:** Pending EPA CONTACT: Harrington, R. E.

600/6-75-001 SIC 286 CHEMICALS IN-HOUSE PROJECT

Scientific and Technical Assessment Report on Particulate Polycyclic Organic Matter (PPOM) Special Studies Staff, EPA Research Triangle Park, NC **ORDER FROM: NTIS-PB** 241 799 $4.75 EPA CONTACT: Carlin, A.

600/6-75-004 SIC 282 CHEMICALS IN-HOUSE PROJECT

Scientific and Technical Assessment Report on Vinyl Chloride and Polyvinyl Chloride Special Studies Staff, EPA Research Triangle Park, NC **ORDER FROM: NTIS-PB** 249 461/AS $5.50

Vinyl chloride (VC) is a chemical of widespread industrial and commercial use. Occupational experience and experimental evidence strongly indicate that it is a carcinogen. Additionally, there is experimental evidence that indicates that it may be a teratogen and mutagen. An increased incidence of liver angiosarcoma, excessive liver damage, and acroosteolysis has been reported among VC workers, and the frequency and severity of the liver pathology is related to the length of exposure. The principal route of exposure is thought to be air inhalation. Sources of increased importance for the general population include food and water. Tumors at multiple and diverse sites have been observed in all species of experimental animals tested for carcinogenicity by inhalation and ingestion of VC. In addition to the health effects of VC, this document also considers the sources, distribution, and control technology.

REPORT ABSTRACTS SECTION

600/7-76-034f SIC 286 CHEMICALS CONTRACT NO. 68-03-2198

Environmental Considerations of Selected Energy Conserving Manufacturing Process Options. Vol. VI. Olefins Industry Report Arthur D. Little, Inc. Cambridge, MA **ORDER FROM: NTIS-PB** 264 272 $6.75 EPA CONTACT: Skovronek, H. S.

600/7-76-034l SIC 281 CHEMICALS CONTRACT NO. 68-03-2198

Environmental Considerations of Selected Energy Conserving Manufacturing Process Options. Vol. XII. Chlor-Alkali Industry Report Arthur D. Little, Inc. Cambridge, MA **ORDER FROM: NTIS-PB** 264 278 $5.00 EPA CONTACT: Skovronek, H. S.

600/7-76-034m SIC 281 CHEMICALS CONTRACT NO. 68-03-2198

Environmental Considerations of Selected Energy Conserving Manufacturing Process Options. Vol. XIII. Phosphorus/ Phosphoric Acid Industry Report Arthur D. Little, Inc. Cambridge, MA **ORDER FROM: NTIS-PB** 264 279 $5.00 EPA CONTACT: Skovronek, H. S.

650/2-74-084 SIC 286 CHEMICALS CONTRACT NO. 24-12-0004

Odor Removal from Air by Adsorption on Charcoal Kansas State University Manhattan, KS **ORDER FROM: NTIS-PB** 236 928/AS $5.25

The report gives results of an evaluation of the efficacy of charcoal for removing odorous organic vapors from extremely low concentrations in air, at ambient conditions. Two systems were studied in detail: acetaldehyde — Pittsburgh PCB charcoal, and ethylmercaptan— Pittsburgh BPL charcoal. Fixed-bed breakthrough data were taken for the acetaldehyde—Pittsburgh PCB charcoal system at an acetaldehyde concentration of 28 ppm. These data were analyzed using a modeling approach that indicated that the rate-controlling step was intraparticle diffusion. Preliminary design calculations based on this work indicate that fixed-bed adsorption with charcoal is a feasible process for the removal of small concentrations of acetaldehyde and ethylmercaptan from polluted air. EPA CONTACT: Murthy, B. N.

650/2-74-095 SIC 281 CHEMICALS GRANT NO. 800950

Fluoride Emissions from Phosphoric Acid Plant Gypsum Ponds North Carolina State University Raleigh, NC **ORDER FROM: NTIS-PB** 241 144/AS $9.50

The report gives results of a study of fluoride emissions from ponds receiving process water from wet-process phosphoric acid plants. Volatile fluorine compounds accumulate in water used in the manufacture of phosphoric acid by the wet-process method. This process water is routed to ponds for cooling and eventual re-use. While in the ponds, some of the fluorine compounds evaporate, becoming air pollutants. Emission estimates were developed from the pond-to-air mass transfer coefficient and the vapor pressure of fluorine over pond water. These estimates were tested by measurements of ambient-air, fluorinecompound concentrations downwind of the ponds. Comparing the measured ambient air concentrations with concentrations predicted from the emission estimates and a standard atmospheric pollutant dispersion model demonstrated the validity of the emission estimates. EPA CONTACT: Murthy, B. N.

650/2-74-097 SIC 282 CHEMICALS CONTRACT NO. 68-02-1325

Vinyl Chloride – An Assessment of Emissions Control Techniques and Costs BY B. H. Carpenter, Research Triangle Institute Research Triangle Park, NC **ORDER FROM: NTIS-PB** 237 343/AS $4.75

The report gives results of a survey of conceptual techniques applicable to vinyl chloride monomer (VCM) emission reduction with respect to VC monomer and polymer production. VCM emission points have been identified and quantified for four types of monomer plants— hydrochlorination of acetylene, chlorination/oxychlorination of ethylene (with oxygen) and dehydrochlorination, and direct chlorination of ethylene and dehydrochlorination—and four types of polymer manufacture—suspension polymerization, emulsion polymerization, bulk polymerization, and solution polymerization. Levels of control achievable and estimated cost of listed control techniques are presented. EPA CONTACT: Baker, K.

REPORT ABSTRACTS SECTION

650/2-74-106 SIC 282 CHEMICALS CONTRACT NO. 68-02-1068

System Analysis of Air Pollutant Emissions from the Chemical/ Plastics Industry Foster D. Snell, Inc. Florham Park, NJ **ORDER FROM: NTIS-PB** 239 880/AS $8.75

The report defines chemical/plastics industry producers, production volume, forecasted growth rates, plant capabilities and locations, and average population densities at each plant site. It describes major processes in terms of equipment, reaction conditions, specific process chemicals, and general air pollution controls. A decision model was used to relate the interactions of such factors as total population exposed, production volume, growth trends, emission, odor, and hazard potential of the most likely pollutants. The report identifies polyurethanes, acrylics, and alkyds as the most likely candidates for in-depth study, estimating emissions factors and discussing emission controls and their costs. It gives similar information for some high-volume plastic materials: polyethylene, polystyrene, polypropylene, nylon, and polyvinyl chloride. Most of the pollution control devices used in the industry are associated with large volume resin manufacture and function primarily to recover product or heat values: in most instances, economics dictate against installing control devices solely for pollution control. The report gives calculated costs for various controls. EPA CONTACT: Murthy, B. N.

650/2-74-107 SIC 282 CHEMICALS CONTRACT NO. 68-02-0228

Characterization of Atmospheric Emissions from Polyurethane Resin Manufacture Midwest Research Institute Kansas City, MO **ORDER FROM: NTIS-PB** 237 420/AS $4.75

The report describes the characterization of air pollutant emissions from a polyurethane resin manufacturing plant. Samples were taken before and after the air pollution control device (scrubber). Analysis for toluene di-isocyanate (TDI) and amines was conducted both on site and on a delayed basis. The sampling train included an impinger for colorimetric measurement of TDI. Cryogenic traps and a tape sampler for TDI were also used for the scrubber inlet samples. The outlet sampling manifold consisted of evacuated bulbs in place of the cryogenic traps because of the high moisture content. TDI emissions were found to be maximum in the first part of the resin formation reaction. It appears there is no emissions hazard. The scrubber had negligible effect on the TDI emissions. EPA CONTACT: Murthy, B. N.

650/2-75-026a SIC 284 CHEMICALS CONTRACT NO. 68-02-1406

Testing of a Molecular Sieve Used to Control Mercury Emission From A Chlor-Alkali Plant, Volume I Engineering Science, Inc. McLean, VA **ORDER FROM: NTIS-PB** 242 005 $4.25

In Part 1 of the report performance testing for mercury emission control was conducted by Engineering-Science, Inc. on the Union Carbide PuraSiv Hg unit currently controlling mercury emissions from the by-product hydrogen steam of the mercury-cell chlor-alkali production facility of Sobin Chlor-Alkali in Orrington, Maine. Simultaneous samplings of adsorber inlet and outlet streams were performed during five consecutive 24-hour adsorption cycles, eight sampling runs per cycle, in accordance with a modified version of EPA Reference Method 102. If operated at design capacity, the estimate outlet mercury concentrations from the PuraSiv Hg unit would average 2.0 micrograms/cu Nm throughout each adsorption cycle, representing a 99.9% collection efficiency. EPA CONTACT: Wooldridge, E. J.

650/2-75-026b SIC 284 CHEMICALS CONTRACT NO. 68-02-1406

Testing of a Molecular Sieve Used to Control Mercury Emission From A Chlor-Alkali Plant, Volume II – Appendices Engineering Science, Inc. McLean, VA **ORDER FROM: NTIS-PB** 242 006 $7.50

As more and more emission standards are enacted, control agencies will be faced with the evaluation of stack test data. A mass emission rate or concentration will be either reasonable, high, or low, and the evaluator is faced with the task of determining which is the case. Part 2 presents a method using specific calculations to determine whether proper sampling conditions (isokinetic for particulates) were actually attained. By calculating the mass emission rate by two methods – (1) by the ratio of areas and (2) by the concentration basis, the ratio of the results yields the apparent average proportion of isokinetic conditions. EPA CONTACT: Wooldridge, E. J.

650/2-75-032a SIC 280 CHEMICALS CONTRACT NO. 68-02-1329

Energy Consumption: The Chemical Industry Dow Chemical Company Freeport, TX **ORDER FROM: NTIS-PB** 241 927/AS $4.25

The report gives results of a study of energy consumption in the chemical industry. It analyzes energy-intensive steps or operations for manufacturing processes which produce 12 of the top 50 volume chemicals in the U.S. Results of the analyses are in the form of energy consumption block diagrams, energy-intensive equipment schematic diagrams, and tables that indicate the causes of energy losses, as well as possible conservation approaches. EPA CONTACT: Jefcoat, I. A.

REPORT ABSTRACTS SECTION

660/2-73-018 SIC 282 CHEMICALS GRANT NO. 12110 GLP

Air Flotation – Biological Oxidation of Synthetic Rubber and Latex Wastewater BY A. H. King, J. Ogea, and J. W. Sutton, Firestone Synthetic Rubber and Latex Company Lake Charles, Louisiana **ORDER FROM: NTIS-PB** 229 408

The operation of a secondary waste-water treatment facility for treatment of the combined wastewater from Firestone's Lake Charles, Louisiana, synthetic rubber manufacturing plant was studied for a period of nine months. The waste-water treatment facility was designed to treat an average daily flow of 3.4 mgd and a BOD load of approximately 2,000 lbs/day. The report describes the laboratory and pilot studies that were performed during the process development phase of the project and presents design data, operational data, and treatment cost data for the full scale facility. EPA CONTACT: Field, J. W.

660/2-75-017 SIC 286 CHEMICALS GRANT NO. 800312

Radiation Treatment of High Strength Chlorinated Hydrocarbon Wastes BY T. F. Craft, R. D. Kimbrough, and C. T. Brown, Georgia Institute of Technology Atlanta, GA **ORDER FROM: NTIS-PB** 244 388/AS $3.75

The possible use of gamma radiation for the treatment of waste effluents containing chlorinated hydrocarbons, particularly pesticides, has been investigated. Significant destruction was obtained of representative compounds such as pentachlorophenol, 2,4,5-trichlorophenoxyacetic acid, and 2,4-dichlorophenoxyacetic acid. Radiation treatment had little effect on polychlorinated biphenyls or mixtures of compounds, including actual manufacturing effluents. It was found that the addition of a material of high atomic weight, such as barium, increased the efficiency of radiation utilization. No other materials were found which increased the desired destruction. G-values were calculated for pentachlorophenol, 2,4,5-trichlorophenoxyacetic acid, and 2,4-dichlorophenoxyacetic acid. It is concluded from the magnitude of these values that radiation treatment of chlorinated hydrocarbons is not economically feasible at the present level of radiation costs. EPA CONTACT: Swank Jr., R. R.

660/2-75-021 SIC 286 CHEMICALS GRANT NO. 800766

Optimizing a Petrochemical Waste Bio-Oxidation System Through Automation BY M. A. Zeitoun, W. F. McIlheny, N. J. Riscan, J. H. Culp, and H. C. Behrens, Dow Chemical Company Freeport, TX **ORDER FROM: NTIS-PB** 247 160 $7.75

Systems were developed to control the critical parameters of the activated sludge process to achieve reliable, high quality effluent. The waste water from a petrochemical plant contained ethylene glycol and was sometimes saline. An automated sampling system, sampling feed and homogenized mixed liquor, monitored the total carbon in both samples. Nutrients were added in proportion to the total carbon in the feed, thus maintaining low residual nutrients in the effluent. The sludge recycle flow rate was controlled by a food to microorganisms signal, measured as the ratio of total carbon in the feed to that in the mixed liquor. Toxic or inhibitory effects of the feed were measured by a Biological Inhibitor Detector, an instrument which measures the oxygen uptake of standard solutions before and after exposure of a bacteria sample to a feed sample and calculates an activity ratio. The use of the instrument as an upstream sensing device was demonstrated as toxic substances were added to the feed. The developed on-line control systems are applicable to municipal, industrial or combined treatment plants. A bibliography of 63 references is included. EPA CONTACT: Short, T. E.

670/2-74-030 SIC 285 CHEMICALS GRANT NO. 800602

Waterborne Wastes of the Paint and Inorganic Pigments Industries BY J. J. Barrett, G. A. Morneo, and J. J. Roden III, Southern Research Institute Birmingham, AL **ORDER FROM: NTIS-PB** 232 019/AS $4.00

The report describes a study of the wastewater management practices in the paint and inorganic pigments industries. Information was obtained from 153 plants manufacturing paints, 10 titanium dioxide plants, and 10 plants that produce other inorganic pigments. The data were analyzed to identify the sources and characteristics of wastewater from the manufacturing processes of these plants, to determine the practices for wastewater control and treatment that are presently employed, and to identify deficiencies in technology that may require research and development to improve control and treatment methods. (Modified author abstract) EPA CONTACT: Skovronek, H. S.

670/2-74-044 SIC 285 CHEMICALS GRANT NO. 12020 ERM

Ion Exchange Process for Recovery of Chromate from Pigment Manufacturing BY D. Robinson, H. Weisberg, G. Chase, K. Libby Jr., and J. Copper, Mineral Pigments, Corporation Beltsville, MD **ORDER FROM: NTIS-PB** 233 641/AS $4.50

Strongly basic ion-exchange resins have been shown to exhibit a preference for dichromate over many other anions in water solution. Laboratory studies were conducted to show that this ion preference could be used to remove chromate from waste waters which were discharged from a zinc yellow pigment manufacturing plant. It was also shown that the recovered chromate solution could be recycled into product manufacture without sacrificing product quality. From these laboratory studies, a full-scale ion-exchange treatment plant was designed, constructed, and demonstrated. The chromate composition of the plant effluent is being reduced from 2700 ppm to one to two ppm. The treatment system was designed to treat 60 gallons per minute of influent and to discharge an effluent which is within statutory limits for pH and for heavy metal content. The plant was designed to require minimal manual supervision. The steps in treatment and in resin regeneration are performed automatically and the control system is interlocked to make it fail safe.

REPORT ABSTRACTS SECTION

670/2-74-017 SIC 283 CHEMICALS GRANT NO. 801159

Characterization of Waste Waters from the Ethical Pharmaceutical Industry BY J. Mayes, Gulf Southern Research Institute for Pharmaceutical Associates Washington, DC **ORDER FROM: NTIS-PB** 233 116

The available information allowed a breakdown into (1) pharmaceutical (formulation) plants, (2) pharmaceutical and chemical (synthesis) plants, and (3) all others (those using fermentation, biological preparation, extraction, and combinations). Analysis of the collected raw effluent data indicated that sanitary wastes were a major contributor in pharmaceutical plants. The wastes of the other categories were more dependent on specific operations and were, consequently, more variable. Fermentation wastes were, as expected, very high in biodegradable organics and usually were the predominant contributor in complex plants. Conventional biological treatment, both in-plant and at central facilities, is widely used and appears capable of achieving 90% removal of degradable organics. Advanced technology appears to be limited in application to specific wastes not amenable to biological treatment.

670/2-75-015 SIC 289 CHEMICALS GRANT NO. 803537

Pilot Plant Optimization of Phosphoric Acid Recovery Process BY L. E. Lancy, F. A. Steward, and J. H. West, Lancy Laboratories Zelienople, PA **ORDER FROM: NTIS-PB** 241 793/AS $3.75

A pilot plant study was carried out which demonstrated the effectiveness and economic feasibility of a unique ion exchange process referred to as "acid retardation" for purifying spent phosphoric acid used in bright finishing aluminum parts. A continuous ion exchange system was employed to separate the aluminum contamination from a spent phosphoric acid waste obtained from a manufacturing plant. The anion resin accomplishes the separation by retarding the phosphoric acid as the processing solution flows through the bed. The aluminum remains in the waste solution and passes out of the column in the effluent. The acid is then eluted from the bed with water, eliminating the use of chemicals which are needed to regenerate the resin in conventional ion exchange systems. EPA CONTACT: Ciancia, J.

600/2-76-009 SIC 207 FOOD PRODUCTS CONTRACT NO. 68-02-1067

Odor Control by Scrubbing in the Rendering Industry BY R. H. Snow, and J. E. Huff, IIT Research Institute Des Plaines, IL BY W. Boehme, Fats and Proteins Research Foundation, Inc. Des Plaines, IL **ORDER FROM: NTIS-PB** 251 187/AS $7.75

The report gives results of experiments conducted at a rendering plant to obtain data needed to design wet scrubber systems for rendering plant odor control. Scrubber performance was measured by both odor panel and gas chromatographic analysis. Experiments in a three-stage packed-bed laboratory-scale scrubber at the rendering plant evaluated solutions of sodium hydroxide and the strong oxidants sodium hypochlorite, hydrogen peroxide, and potassium permanganate. Since removal of 90% per stage was obtained with fresh alkaline sodium hypochlorite solution, this reagent was selected for subsequent longer-term tests. A three-stage packed-bed scrubber was evaluated to replace an existing incinerator being used to treat a process air stream that contained from 5000 to 50,000 odor units. A week-long test with the scrubber gave a lower-than-expected average odor reduction of 85%. Data was obtained on chemicals consumption and effect of flow variables on odor removal; these data were used to update computer models that can be used to design scrubbers for odor removal. EPA CONTACT: Wooldridge, E. J.

600/2-76-160a SIC 200 FOOD PRODUCTS CONTRACT NO. 68-02-1412

IERL-RTP Procedures Manual: Level 1 Environmental Assessment BY J. W. Hamersma, S. L. Reynolds, and R. F. Maddalone, TRW Systems Group Redondo Beach, CA **ORDER FROM: NTIS-PB** 257 850 EPA CONTACT: Statnick, R. M.

600/2-76-214 SIC 201 FOOD PRODUCTS IN-HOUSE PROJECT

Workshop on In-Plant Waste Reduction in the Meat Industry BY J. L. Witherow, and J. F. Scaief, Industrial Environmental Research Laboratory, EPA Corvallis, OR **ORDER FROM: NTIS-PB** 258 742/as $6.75

Presented are the proceedings of a workshop on in-plant waste reduction in the meat industry. Forty-five participants from industry, government, and private firms exchanged ideas and experiences on waste reduction during the two-day session. Topics covered were: pens, blood conservation and processing, paunch and viscera handling, rendering and plant clean-up operations. Case histories are presented on water conservation in a meat packing plant and in a hog processing plant.

600/2-76-224 SIC 200 FOOD PRODUCTS IN-HOUSE PROJECT

Proceedings of the Sixth National Symposium on Food Processing Wastes Industrial Environmental Research Laboratory, EPA Corvallis, OR **ORDER FROM: NTIS-PB** 266 360 $12.50 EPA CONTACT: Dostal, K. A.

REPORT ABSTRACTS SECTION

600/2-76-236 SIC 203 FOOD PRODUCTS GRANT NO. 11060 DJB

anaerobic and aerobic treatment of combined potato processing/Municipal Wastes BY J. K. Neel, J. W. Vennes, G. O. Fossum, and F. B. Orthmeyer, Grand Forks, City of Grand Forks, ND **ORDER FROM: NTIS-PB** 265 009 $6.00 EPA CONTACT: Thompson, H. W.

600/2-76-253 SIC 203 FOOD PRODUCTS GRANT NO. 802307

Cannery Waste Biological Sludge Disposal as Cattle Feed BY L. A. Esvelt, Bovay Engineers, Inc. Spokane, WA **ORDER FROM: NTIS-PB** 265 357 $4.50 EPA CONTACT: Thompson, H.

600/2-76-254 SIC 202 FOOD PRODUCTS GRANT NO. 12060 DEQ

Elimination of pollution from Cottage Cheese Whey by Drying and Utilization BY S. Boxer, and R. W. Bond, Dairy Research and Development Corporation Peekskill, NY **ORDER FROM: NTIS-PB** 266 265 $4.50 EPA CONTACT: Cochrane, M. W.

600/2-76-294 SIC 207 FOOD PRODUCTS GRANT NO. 12060 FDK

Treatment of Effluent Waters from Vegetable Oil Refining BY D. F. Gill, and J. C. Ielease, Archer Daniels Midland Company Decatur, IL **ORDER FROM:** Pending EPA CONTACT: Risley Jr., C.

600/2-76-302 SIC 201 FOOD PRODUCTS GRANT NO. 801028

Treatment of High Strength Meatpacking Plant Wastewater by Land Application BY A. J. Tarquin, Texas, University of El Paso, TX **ORDER FROM:** Pending EPA CONTACT: Thomas, R. E.

600/2-76-304 SIC 200 FOOD PRODUCTS IN-HOUSE PROJECT

Proceedings Seventh National Symposium on Food Processing Wastes Industrial Environmental Research Laboratory, EPA Cincinnati, OH **ORDER FROM: NTIS-PB** 265 698 $12.75 EPA CONTACT: Dostal, K. A.

600/2-77-048 SIC 208 FOOD PRODUCTS IN-HOUSE PROJECT

State of the Art: Wastewater Management in the Beverage Industry BY M. E. Joyce, J. F. Scaief, M. W. Cochrane, and K. A. Dostal, Industrial Environmental Research Laboratory, EPA Corvallis, OR **ORDER FROM:** Pending EPA CONTACT: Dostal, K. A.

600/6-75-003 SIC 200 FOOD PRODUCTS IN-HOUSE PROJECT

Scientific and Technical Assessment Report on Cadmium Special Studies Staff, EPA Research Triangle Park, NC **ORDER FROM: NTIS-PB** 246 820/AS $4.50

The report is a review and evaluation of the current knowledge of cadmium in the environment as related to possible deleterious effects on human health and welfare. Sources, distribution, measurement, and control technology are also considered. Cadmium is widely distributed in the environment. The air over urban areas has contained generally less than 0.1 microgram per cubic meter, 24-hour average, but a 24-hour average as high as 0.73 microgram/cu m has been measured in the air of a community with a known cadmium source. The cadmium content of water generally is less than 1 part per billion although much higher values have been found. The cadmium content in foods varies widely. The estimated intake from foods is 25 to 75 micrograms per day. Food and tobacco smoke are the major sources except in the immediate vicinity of major sources of atmospheric emissions of cadmium. Emphysema and other lung deseases have been related to industrial exposure. Kidney damage has also resulted from long-term exposure to cadmium. Animal experiments link anemia, hypertension, testicular necrosis, and carcinogenesis with cadmium exposure.

650/2-75-032c SIC 200 FOOD PRODUCTS CONTRACT NO. 68-02-1329

Energy Consumption: Paper, Stone/Clay/Glass/Concrete, and Food Industries Dow Chemical Company Freeport, TX **ORDER FROM: NTIS-PB** 241 926/AS $4.25

The report gives results of a study of energy consumption in the paper, stone/clay/glass/concrete, and food industries. It analyzes energy-intensive steps or operations for commonly used manufacturing processes. Results of the analyses are in the form of energy consumption block diagrams, energy-intensive equipment schematic diagrams, and tables that indicate the causes of energy losses, as well us possible conservation approaches. EPA CONTACT: Jefcoat, I. A.

REPORT ABSTRACTS SECTION

660/2-73-015 SIC 207 FOOD PRODUCTS GRANT NO. 12060 DQV

Recovery of Fatty Materials From Edible Oil Refinery Effluents BY W. C Seng, Swift and Company Oakbrook, IL **ORDER FROM: NTIS-PB 231 268/AS**

New full scale equipment and modification to the existing standard waste treatment equipment were installed at the Swift & Company modern, high-volume, edible fat and oil refining plant at Bradley, Illinois, complete with necessary controls and instrumentation to study methods for removing and upgrading the fatty materials for resale. An in-plant survey was conducted. The waste streams were characterized as to source, flow rate, and either solubles, suspended solids and BOD content. Synthetic acrylamide polymers were laboratory tested as flocculants in combination mainly with alum for plant waste water clarification. Cathodic protection devices and impressed current successfully controlled corrosion and build-up of solids on the walls of the existing Skimmer and Air Flotation Units. A DeLaval PX-213 bowl opening, disc stack, centrifuge was tested to concentrate and upgrade the removed fatty materials after caustic and sulfuric acid treatment. An overall economic evaluation indicated 7000 pounds of oil recovered would offset 60% of the total daily direct operating costs for the waste treatment system, including the oil reclaiming system. (Modified author abstract) EPA CONTACT: Risley, C.

660/2-73-021 SIC 203 FOOD PRODUCTS GRANT NO. 12060 FRW

Waste Control and Abatement in the Processing of Sweet Potatoes BY C. Smallwood, North Carolina State University Raleigh, NC **ORDER FROM: NTIS-PB** 238 469

The conventional processing of sweet potatoes produces a very strong caustic waste that is high in organic matter. Present technology does not emphasize recirculation or other control of water use. Improved technology is available such as high pressure low-volume water sprays and a dry caustic peeling process that reduce water use and convert the liquid caustic waste to a semi-solid waste that can be disposed of in sanitary landfills or sold as cattle feed. Developing technology offers the potential of lye recovery, an improved steam peel or an infrared dry caustic peel that increases yield. In-plant control of waste through process modification and/or treatment is economical and may even provide a net return on investment. Biological treatment is effective.

660/2-73-031 SIC 200 FOOD PRODUCTS IN-HOUSE PROJECT

Proceedings Fourth National Symposium on Food Processing Wastes Pacific Northwest Environmental Research Laboratory, EPA Corvallis, OR **ORDER FROM: NTIS-PB** 234 606

The Proceedings contains copies of 25 of the 27 papers presented at the Symposium. Subjects included: waste characterization, product and by-product recovery, process modification, and wastewater treatment of many different segments of the food processing industry. Typical papers include: biological treatment of winery stillage, meat packing wastewater, potato processing wastes, dairy wastewaters, distillery wastes and egg processing wastewaters; process modifications for blanching vegetables; as well as by-product recovery from fish processing effluents, cheese whey and sauerkraut wastewaters.

660/2-74-006 SIC 203 FOOD PRODUCTS GRANT NO. 801484

Wastewater Abatement in Canning Vegetables by IQB Blanching BY D. B. Lund, Wisconsin, University of Madison, WI **ORDER FROM: NTIS-PB** 234 495

A study on the efficacy of a new blanching system, Individual Quick Blanch (IQB), as applied to vegetables prior to canning was conducted. Peas, corn, lima beans, green beans, potatoes, carrots and beets were adequately blanched by IQB. Compared to deep bed steam blanching or pipe blanching, IQB generally resulted in a significant reduction of effluent. Slight drying of the vegetables before IQB reduced effluent even more; however, product quality was adversely affected in most cases. It was demonstrated that the IQB process can significantly reduce effluent volume and BOD generation in the blanching operation while adequately fulfilling the objectives of blanching. Recommendations for commercial development of IQB are given. EPA CONTACT: Thompson, H.

660/2-74-012 SIC 202 FOOD PRODUCTS GRANT NO. 12060 EKQ

Treatment of Cheese Processing Wastewaters in Aerated Lagoons BY F. R. Daul, Kent Cheese Company Melrose Park, IL **ORDER FROM: NTIS-PB** 237 334/AS

A full-scale treatment of wastewater from a cheese processing operation was conducted over a one year period. A two-stage aerated lagoon system provided an average BOD removal of 97% at BOD loadings ranging from 0.117 to 4.34 lb/1000cu ft/day. Hydraulic detention time varied from 50 to 82 days per lagoon. Temperature had the single greatest influence on process efficiency. Costs for lagoon operation, maintenance and amortization were estimated to be $2.15 per 1000 gallons or $0.14 per pound BOD applied. EPA CONTACT: Cochrane, M. W.

REPORT ABSTRACTS SECTION

660/2-74-014 SIC 208 FOOD PRODUCTS GRANT NO. 12060 FLL

Activated Sludge – Bio-Disc Treatment of Distillery Wastewater BY J. L. Thomas, and L. G. Koehrsen, Stanley Consultants, Inc. Muscatine, IA American Distilling Company Pekin, IL **ORDER FROM: NTIS-PB** 234 383

Plant scale evaluation of activated sludge and Bio-Disc treatment of distillery wastewater has been conducted over a period of more than one year at Pekin, Illinois. The activated sludge process consistently provided in excess of 90 percent removal of BODs, even at loadings greater than the treatment plant design levels. The Bio-Disc process had to be down-rated from the original design basis in order to approach a comparable removal efficiency. Of the two systems evaluated, the activated sludge process was the more desirable from standpoints of economics, treatment performance, and ability to handle shock loads. EPA CONTACT: Cochrane, M. W.

660/2-74-020 SIC 201 FOOD PRODUCTS GRANT NO. 12130 EKK

Evaluation of Polymeric Clarification of Meat-Packing and Domestic Wastewaters Metropolitan Sewer Board St. Paul, MN **ORDER FROM: NTIS-PB** 235 900/AS

Laboratory tests were conducted to determine which system of chemicals would be most effective on combined packinghouse and domestic waste. This was a combination of ferric chloride and an anionic polyelectrolyte. This system was effective in forming a floc which would settle out under the dynamic conditions of the overloaded primary sedimentation tank. Treatment with this system could effectively reduce suspended solids in the effluent of the primary sedimentation tank over what could be achieved without the use of this dual system. This was demonstrated by running: (1) a parallel system of identical tests and control tanks and, (2) full plant scale investigation for both test and control periods, kept as identical as possible. When full plant scale tests were run, laboratory data were collected from various sampling points throughout the plant during the test and control periods. A significant reduction of BOD and suspended solids was obtained in the primary sedimentation tanks and a change in efficiency was not observed on the trickling filters resulting in an overall reduction in these parameters in the effluent from the secondary sedimentation tank. The cost of chemically treating the combined 10 mgd of wastewater would be approximately $45 per million gallons and would be less for strictly domestic wastes.

660/2-74-025 SIC 202 FOOD PRODUCTS GRANT NO. 800747

Protein Production from Acid Whey VIA Fermentation BY S. Bernstein, and T. C. Everson, Milbrew, Inc. Juneau, WI **ORDER FROM: NTIS-PB** 235 504/AS

From the operation of a demonstration pilot plant over extended periods of time, it has been shown that yeast may be grown on an acid whey or sweet whey medium in a continuous, deep tank aerated fermentor. Variations in fermentation conditions, strain selection, and medium composition produced cell concentrations of several billion cells per milliliter. By a process of evaporation and spray drying the whole fermented whey mass and the utilization of the evaporator condensate to dilute incoming condensed whey, a high grade, non-toxic, protein feed material may be produced without any effluent streams. Amino acid analyses and protein efficiency ratios are presented for this feed material. This whey fermentation is one means of converting large quantities of a potential environmental pollutant into a useful and needed product. EPA CONTACT: Dostal, K. A.

660/2-74-027 SIC 201 FOOD PRODUCTS GRANT NO. 12060 DFF

Treatment of Packing House Waste by Anaerobic Lagoons in Plastic-Media Filters BY D. A. Baker, A. H. Wymore, and J. E. White, Family and Foods, Inc. Denison, IA **ORDER FROM: NTIS-PB** 235 566/AS

Studies were conducted to demonstrate the efficiency and suitability of using dissolved air flotation, anaerobic lagoons, plastic media trickling filters and chlorination as a system for treating one mgd of wastewater from a meat packing plant. The primary objective was to determine if the plastic media filters could be used to replace the aerobic lagoon system normally used to treat the anaerobic lagoon effluent. The overall reduction of five-day Biochemical Oxygen Demand (BODs) through the system averaged 98.5% over the ten month evaluation period leaving a discharge concentration of 61 mg/1. Suspended solids were reduced 95.4% through the entire system, leaving an effluent concentration of 90 mg/1 after chlorination. The BODs reduction in the anaerobic lagoons averaged 82% and accounted for the majority of BODs removed in the system.

660/2-74-028 SIC 206 FOOD PRODUCTS GRANT NO. 12060 FAK

Biological Treatment of Concentrated Sugar Beet Wastes BY J. H. Fisher, Beet Sugar Development Foundation Fort Collins, CO **ORDER FROM: NTIS-PB** 240 123/AS $4.75

A study of the variables influencing a closed loop recirculating flume water system for conveying sugarbeets for processing was conducted at Longmort, CO. Settleable solids were removed by screening, addition of milk of lime and settling; the concentration of dissolved solids increased daily during the processing season. The increasing concentration caused no problem provided the pH was 10 or greater and that the water temperature did not exceed 20C. A deep anaerobic pond received surplus system waters and the total system waters when operations ceased. Anaerobic digestion was aided by addition of nutrients and odors reduced by surface aeration. Water eventually met discharge standards, and was used the second year to fill the system. EPA CONTACT: Scott, R. H.

REPORT ABSTRACTS SECTION

660/2-74-031　　SIC 201 FOOD PRODUCTS　　GRANT NO. 12060 EGV

Water and Waste Management in Poultry Processing BY R. E. Carawan, J. Macon, and W. M. Crosswhite, North Carolina State University Raleigh, NC BY B. K. Hawkins, Gold Kist, Inc. Durham, NC **ORDER FROM: NTIS-PB 235 359/AS** $7.50

A typical broiler processing plant was used to evaluate changes in equipment and processing techniques to reduce water use and waste load. Production at the plant was through two processing lines and totaled approximately 70,000 broilers per day. Benchmark results indicated a water use of 12.28 gallons per bird which was reduced by 32% to 7.81 gallons per bird received. Benchmark results indicated a daily waste load of 3970 lbs BOD5 received which was reduced by 66% to 1355 lbs BOD5. Changes made are detailed and economic analysis showed all to be profitable for the plant with an average annual net savings of $4.08 per 1000 broilers processed. Annual operating costs were $31,023 with annual net savings of $72,193. A water and waste management program is detailed.

660/2-74-035　　SIC 202 FOOD PRODUCTS　　GRANT NO. 12060 ESY

Improvement of Treatment of Food Industry Waste BY S. B. Tuwiner, RAI Research Corporation Haupage, Long Island, NY **ORDER FROM: NTIS-PB** 234 444

Laboratory studies were conducted to determine the feasibility of reducing the COD demand of cheese whey waste generated from dairy processing plants. Three primary processing variables were studied: Agitation, temperature, and current density. Results indicate electrolytic oxidation efficiency was best at 70C, agitation at 9.6 feet per second and a current density of 9.5 amperes per square foot (equivalent to 6 amperes in the test cell investigated). Concentration of 60 percent of the whey protein was also possible by collection of the froth produced during electrolysis. This mechanism of COD reduction could afford recoverable protein from the whey. Carbon adsorption of the electrolyzed whey was also shown to be extremely effective in reducing the COD. The carbohydrates after oxidation to carboxylic acids are very readily adsorbed, the carbon loading being in excess of that expected for secondary effluents. The feasibility of combining the electrolytic oxidation with froth collection and carbon adsorption is proposed as a possible attractive procedure for recovery of values from the whey.

660/2-74-041　　SIC 200 FOOD PRODUCTS　　IN-HOUSE PROJECT

Wastewater Use in the Production of Food and Fiber—Proceedings of a Conference Held at Oklahoma City, OK, March 5-7,1974 Robert S. Kerr Environmental Research Laboratory Ada, OK **ORDER FROM: NTIS-PB** 245 176 $13.25

660/2-74-046　　SIC 201 FOOD PRODUCTS　　GRANT NO. 800746

Paunch Manure as a Feed Supplement in Channel Catfish Farming BY R. C. Summerfelt, Oklahoma State University Stillwater, OK S. C. Yin, Robert S. Kerr Environmental Research Laboratory, EPA Ada, OK **ORDER FROM: NTIS-PB** 235 575/AS

660/2-74-058　　SIC 200 FOOD PRODUCTS　　IN-HOUSE PROJECT

Proceedings: Fifth National Symposium on Food Processing Wastes BY K. A. Dostal, Pacific Northwest Environmental Research Laboratory, EPA Corvallis, OR **ORDER FROM: NTIS-PB** 237 520/AS $6.30

The Proceedings contains copies of 19 of the 20 papers presented at the two and one-half day symposium. Typical papers include: wastewater characterization for the specialty food industry; treatment of shrimp processing, rum distillery, vegetable oil refinery, and meat processing wastewaters; process modifications for cleaning and peeling of tomatoes, and blanching and cooling of vegetables; by-product recovery from meat processing wastes, fish processing wastes, and waste activated sludge; wastewater reuse in poultry processing; and economics of treating fruit and vegetable processing wastewaters.

660/2-74-059　　SIC 208 FOOD PRODUCTS　　GRANT NO. 12060 HCW

Submerged Combustion Evaporator for Concentration of Brewery Spent Grain Liquor BY J. L. Stein, Anheuser Busch St. Louis, MO **ORDER FROM: NTIS-PB** 238 475/AS

A major waste stream in many breweries is the liquor resulting from spent grains dewatering prior to drying. This liquor may account for a third or more of the BOD5 and suspended solids generated by a typical brewery. Initial studies of the spent grain liquor problem indicated that recovery rather than treatment was the best approach. A number of evaporators were evaluated to determine which design was most satisfactory for concentrating the liquor. A submerged combustion evaporator was selected on the basis of engineering analysis and pilot scale tests. A full scale unit was installed at the Houston brewery of Anheuser-Busch, Inc. in 1970. This evaporator was modified several times to overcome failures of the burner downcomers brought about by high temperatures.

REPORT ABSTRACTS SECTION

660/2-74-060 SIC 201 FOOD PRODUCTS GRANT NO. 12060 FYG

Poultry Processing Wastewater Treatment and Reuses BY J. D. Cliese, Maryland, State of, Department of Health and Mental Hygiene Baltimore, MD **ORDER FROM: NTIS-PB** 237 185/AS

The feasibility of reclaiming poultry processing wastewater for reuse where potable water is presently required was studied at the Sterling Processing Corporation plant in Oakland, MD, by the Maryland State Department of Health and Mental Hygiene. In addition, extensive study was made of poultry processing raw waste characteristics and proportions of wastes generated during processing and plant cleanup. Effluent characteristics from a two-stage aerated lagoon are reported. The reclaiming process consisted of a two-stage aerated lagoon wastewater treatment system followed by an advanced water treatment system of microstraining, flocculation, sedimentation, and sand filtration. The bacteriological, chemical, and physical drinking water standards of the U.S. Public Health Service were consistently met.

660/2-74-061 SIC 209 FOOD PRODUCTS GRANT NO. 800904

Shrimp Canning Waste Treatment Study BY A. F. Maudlin, and A. J. Szabo, Dominque, Szabo and Associates, Inc. Lafayette, LA **ORDER FROM: NTIS-PB** 239 050/AS

Wastewater surveys were performed at several Gulf shrimp canneries over a period of three canning seasons. Water used for each process within the plant was metered and the wastewater was tested for biological, chemical and physical characteristics. Pilot screening tests were made over two canning seasons. Tangential, rotary and vibrating screens were evaluated. A 272 cu. m/day (50 gpm) dissolved air flotation pilot plant with chemical addition and pH control was tested at the study plant over two canning seasons. A pilot basket centrifuge was evaluated for sludge dewatering. The study demonstrated that: (1) The waste poundage discharged per pount of raw shrimp processed is similar in most Gulf shrimp canning plants; (2) Screening removal of heads and shells can be performed efficiently and with few operational problems; and (3) air flotation showed promise as a wastewater treatment method. When performing properly, treatment efficiencies were good; however, the operation was sensitive and treatment efficiencies that can be expected on a plant scale remain to be demonstrated.

660/2-74-074 SIC 208 FOOD PRODUCTS GRANT NO. 800935

Rum Distillery Slops Treatment by Anaerobic Contact Process BY T. Shea, E. Ramos, J. Rodriguez, and G. Dorion, Bacardi Company San Juan, PR **ORDER FROM: NTIS-PB** 238 291/AS

The general objectives of the present study were to develop an anaerobic digestion process for the treatment of the rum distillery slops stream at the pilot scale, and to establish design criteria for the full-scale application of the process. Both bench and pilot-scale experimental studies were conducted with the anaerobic contact process flow sheet (incorporating biomass recycle) to permit determination of the Monod kinetic constants and the kinetic relationships describing the anaerobic treatment of the slops. The process kinetics were used to examine the operating and performance characteristics of a plant-scale application. A process flow sheet was established and design criteria developed as the basis for estimating the cost of a plant-scale installation. The process kinetic relationships and the economic analysis were used to structure a cost-performance relationship to examine tradeoffs between cost, performance, and selected design variables. EPA CONTACT: Keeler, H. G.

660/2-74-075 SIC 203 FOOD PRODUCTS GRANT NO. 801684

Wastewater Characterization for the Specialty Food Industry BY C. J. Schmidt, J. Farquhar, and E. V. Clements, SCS Engineers Long Beach, CA **ORDER FROM: NTIS-PB** 239 968/AS $5.75

The specialty food industry generally falls within SIC Codes 2032, 2035 and 2037 and includes approximately 2,300 plants in the United States which produce a wide variety of food products. For waste categorization purposes the specialty food industry was divided into ten categories on the basis of ingredients used, type of product, and liquid waste generation. Twenty-six nationally distributed specialty food plants were investigated and 24 of these field sampled for 10 days each to determine raw wastewater characteristics and volume. Related production and processing information was used to calculate the wastewater generation per 1,000 kilograms of production in terms of: five day biochemical oxygen demand, chemical oxygen demand, suspended solids, volatile suspended solids, total phosphorus, total Kjeldahl nitrogen, grease and oil. EPA CONTACT: Thompson, H.

660/2-74-088 SIC 203 FOOD PRODUCTS GRANT NO. 12060 EIG

Infrared Dry Caustic vs. Wet Caustic Peeling of White Potatoes BY O. Sproul, J. Vennes, W. Knudson, and J. W. Cyr, Western Potato Service, Inc. Grand Forks, ND Potato Service, Inc. Presque Isle, ME **ORDER FROM: NTIS-PB** 244 408/AS $4.25

The increased demand for processed potatoes in the form of dehydrated or frozen products has occurred concomitantly with an increased demand for treatment of the processing wastes. Although biologic decomposition and stabilization of the conventional caustic peel effluent can be accomplished by several well-established practices, a system of peeling which yields wastes of lower concentration and less liquid volume has obvious advantages. Additionally, since potato wastes are acceptable as feeds for livestock, the system devised should allow maximum recovery of these utilizable solids. EPA CONTACT: Dostal, K.

REPORT ABSTRACTS SECTION

660/2-74-091 SIC 203 FOOD PRODUCTS GRANT NO. 800280

Continuous Inplant Hot Gas Blanching of Vegetables BY J. W. Ralls, and W. A. Mercer, National Canners Association Berkeley, CA **ORDER FROM: NTIS-PB** 238 601/AS $5.50

An experimental hot-gas blancher was operated in two food processing plants using green beans, corn-on-cob, beets, spinach, and green peas. A side stream of commercially prepared vegetables was hot-gas blanched and returned to the production line. Electrical, gas, and steam flow meters were used with the hot-gas blancher to obtain data for each commodity studied; these were measured for volumes and analyzed for BOD, COD, SS and pH. Comparisons were made of reductions in wastewater volume, BOD, COD and SS when steam or hot-water blanching were replaced by hot-gas blanching. For beans, spinach and peas these reductions were 91 to 99%. Operational costs were higher for hot-gas blanching than for steam or hot-water blanching for all vegetables studied except for green beans which were slightly lower. EPA CONTACT: Thompson, H.

660/2-74-092 SIC 203 FOOD PRODUCTS GRANT NO. 12060 HFY

Dry Caustic Heating of Clingstone Peaches on a Commercial Scale BY H. E. Stone, DelMonte Corporation San Francisco, CA **ORDER FROM: NTIS-PB** 239 751/AS $4.25

The study evaluates the peel removal ability and rinse water characteristics for the first commercially sized equipment using the principle of rapidly rotating rubber discs to gently wipe softened peel and flush it into the liquid effluent from the plant from where it cannot be easily separated. The dry caustic unit demonstrates that gentle abrasion can remove the softened peel, yield a peach suitable for commercial canning and allow for separation and collection of a major portion of this solid residue thereby preventing its entry into the liquid waste stream. In addition to an approximately 60% reduction in the BOD loading in the liquid waste stream, an approximately 90% reduction in the fresh water requirements for this phase of the preparation of Cling peaches is demonstrated. These reductions in volume of liquid effluent and in the total pounds of organic matter which must be treated are beneficial to both private and public wastewater treatment facilities. EPA CONTACT: Thompson, H.

660/2-74-093 SIC 206 FOOD PRODUCTS GRANT NO. 12060 ESC

Separation, Dewatering, and Disposal of Sugar Beet Transport Water Solids Phase I BY I. V. Fordyce, and A. M. Cooley, American Crystal Sugar Company Denver, CO **ORDER FROM: NTIS-PB** 239 200/AS

The objectives of this study were to determine the settling characteristics of solids from sugar beet washing and fluming operations in a clarifier, the filtering characteristics of the underflow slurry from a clarifier and the disposal of the filter cake without subsequent development of objectionable odors. The results of this study were to be used to determine the feasibility of installing full scale filters for filtration of and removal of the suspended solids from the transport water and complete recycling of water. Buildup of organic matter in the water and consequent bacterial growth necessitated the maintenance of high pH by addition of slacked lime. It was necessary also at intervals to add paraformaldehyde to control bacterial growth. Dosages are given. Best conditions for filtration were obtained when the underflow from the clarifier was heated, the pH was maintained over 10.5 and then the waste lime cake from beet juice purification was added to the feed added to the clarifier. EPA CONTACT: Thompson, H.

660/2-75-001 SIC 203 FOOD PRODUCTS GRANT NO. 801432

Waste Citrus Activated Sludge As a Poultry Feed Ingredient BY R. H. Jones, J. T. White, and B. L. Damron, Winter Garden Citrus Products Cooperative Winter Garden, FL **ORDER FROM: NTIS-PB** 240 672/AS $4.25

The report presents an evaluation of the potential of using waste activated sludge as a poultry feed supplement. The sludge used in this study was obtained from an activated sludge process treating concentrated citrus waste containing no sanitary wastewater. The sludge was thickened, dewatered and dried using full-scale and pilot-scale equipment. The dried sludge was then analyzed for protein, fiber, amino acids, nutrients and moisture. Poultry feeds containing varying concentrations of sludge were prepared. Two experiments with broiler chicks, each of 3 weeks duration, one 8-week broiler study, and a 6-month laying hen study were conducted to determine the effect of the inclusion of sludge in poultry diets on performance. It is shown in the report that the inclusion of sludge in properly formulated diets up to 7.5% did not significantly affect poultry performance or meat or egg quality. The value of the sludge was calculated based on the reduction in feed ingredients resulting from the inclusion of sludge. It was found that the value of the recovered sludge significantly reduced the total cost of sludge handling. EPA CONTACT: Thompson, H.

660/2-75-002 SIC 208 FOOD PRODUCTS GRANT NO. 12060 HPC

Pilot Scale Treatment of Wine Stillage BY E. D. Schroeder, California, University of Davis, CA **ORDER FROM: NTIS-PB** 240 996/AS $5.75

Pilot and laboratory scale studies were run on aerobic and anaerobic biological treatment of winery stillage over a two year period. The pilot scale studies included work with aerobic lagoons and anaerobic packed towers. Laboratory systems studied were aerobic reactors without recycle and batch fed anaerobic processes. Because suspended solids removal proved to be a key factor in successful biological treatment, centrifugation, detartration, coagulation and flocculation, and combinations of these methods were included in the studies. Centrifugation proved to be the best method of removing solids prior to biological treatment. Solids removal in combination with an aerobic treatment process can be expected to produce final filtrate chemical oxygen demands of about 700 mg/1 and a final filtrate BOD of about 75 mg/1. Anaerobic processes studied did not operate well but produced effluents with chemical oxygen demands of the order of 4000 mg/1. EPA CONTACT: Cochrane, M.

REPORT ABSTRACTS SECTION

640/2-75-019 SIC 201 FOOD PRODUCTS GRANT NO. 802174

Egg Breaking and Processing Waste Control and Treatment BY W. J. Jewell, H. R. Davis, O. F. Johndrew Jr., R. C. Loehr, W. Siderewicz, and R. R. Zall, Cornell University Ithaca, NY **ORDER FROM: NTIS-PB** 245 588/AS $7.00

Eleven percent of the eggs produced in the U.S. are handled by egg breaking facilities to produce more than 800 million pounds of various egg products annually. Five egg breaking plants were sampled which covered a size ranging from small installations to one of the largest. The wastewater was highly contaminated, with total COD exceeding 6000 mg/1 or greater. The product loss average was 12.5 percent of the weight of the processed product. Unit process losses were 0.034 kg BOD D sub 5 and 7.5 liters per kg of egg liquid produced. In-plant waste conservation methods were demonstrated to decrease BODs and wastewater volume losses by 50 and 24 percent, respectively. These reductions in product loss resulted in recovery of product with a value between $250 and $500 per day for a medium sized facility. Aerobic lagoons with 30 day HRT reduced the total COD from 5800 mg/1 to 1000 mg/1. Of the four treatment systems tested, only a combination of an anaerobic lagoon followed in series with an aerated lagoon and a liquid solids separation step produced a dischargable effluent with soluble BOD D sub 5 less than 15 mg/1. EPA CONTACT: Witherow, J.

600/2-76-032b SIC 321 MISCELLANEOUS CONTRACT NO. 68-02-1874

Source Assessment: Flat Glass Manufacturing Plants BY R. B. Reznik, Monsanto Research Corporation Dayton, OH **ORDER FROM: NTIS-PB** 252 356/AS $6.75

The report describes air pollutants emitted during the production of flat glass, SIC No. 3211. It covers raw materials preparation at the plant site, molten glass production in the melting furnace, and the forming of flat glass products. Melting furnace emissions account for over 99% of the total plant emissions; NO(x), SO(x), and particulates are the major (w99%) pollutants. The particulates are alkali sulfates of submicron size. NO(x) has the highest emission factor. Source severity is a measure of the potential environmental effect of air emissions from this industry: it is defined as the ratio of the maximum average ground level concentration compared to the primary ambient air quality standard for criteria pollutants. The largest severity factors are for NO(x) emissions from a 30 m stack (Ss 1.3) and a 60 m stack (Ss 0.57). Severities for SO(x) and particulates are in the range 1.0–0.05. EPA CONTACT: Denny, D. A.

600/2-76-065 SIC 329 MISCELLANEOUS CONTRACT NO. 68-02-1353

Assessment of Particle Control Technology for Enclosed Asbestos Sources—Phase II BY P. C. Siebert, T. C. Ripley, and C. F. Harwood, IIT Research Institute Chicago, IL **ORDER FROM: NTIS-PB** 251 623/AS $6.00

The report gives results of an experimental study to optimize control of emissions of asbestos fibers using a baghouse. Baghouse operating parameters found to be statistically significant in reducing asbestos emissions were: bag fabric, waste type, air-to-cloth ratio, relative humidity, period between shakes and duration of shaking, and shaking amplitude. Values of these operating parameters are recommended for industry usage to significantly reduce outlet concentrations of asbestos. These operating conditions resulted in pressure drops across the fabric filter that were quite reasonable. The most economical alternatives of cotton sateen bags, high air-to-cloth ratio, and low pressure drop operating conditions were found to be among the most significant in reducing asbestos emissions. Among the recommendations are: an air-to-cloth ratio of 1.22 cu m/min/sq m (4.0 cfm/sq ft), a combination of period between shakes of 120 min with a shaking duration of 20 sec, and a shaking amplitude of 3.500 cm. EPA CONTACT: Oestreich, D. K.

600/2-76-089a SIC 324 MISCELLANEOUS CONTRACT NO. 68-02-2110

Technical Manual for Measurement of Fugitive Emissions: Upwind/Downwind Sampling Method for Industrial Emissions BY H. J. Kolmsberg, Research Corporation of New England Wethersfield, CT **ORDER FROM: NTIS-PB** 253 092/AS $5.00

The manual provides a guide for the implementation of the Upwind/Downwind Sampling Strategy in the measurement of fugitive emissions. Criteria for the selection of the most applicable measurement method and discussions of general information gathering and planning activities are presented. Upwind/downwind sampling strategies and equipment are described. The design of the sampling system, sampling techniques, and data reduction procedures are discussed. Manpower requirements and time estimates for typical applications of the method are presented for programs designed for overall and specific emissions measurements. The application of the outlined procedures to the measurement of fugitive emissions from a Portland cement manufacturing plant is presented as an appendix. EPA CONTACT: Statnick, R. M.

600/2-76-164 SIC 324 MISCELLANEOUS CONTRACT NO. 68-02-1480

Evaluation of Rexnord Gravel Bed Filter BY J. D. McCain, Southern Research Institute Birmingham, AL **ORDER FROM: NTIS-PB** 255 095 EPA CONTACT: Harmon, D. L.

600/2-76-194 SIC 324 MISCELLANEOUS GRANT NO. 802196

Elimination of Water Pollution by Recycling Cement Plant Kiln Dust BY N. R. Greening, F. M. Miller, C. H. Weise, and H. Nagao, Portland Cement Association Skokie, IL **ORDER FROM: NTIS-PB** 259 080 $4.50 EPA CONTACT: D. L. Wilson

REPORT ABSTRACTS SECTION

600/2-76-230 **SIC 311 MISCELLANEOUS** **IN-HOUSE PROJECT**

Leather Tanning and Finishing Waste Management Research and Development Program BY J. F. Scaief, Industrial Environmental Research Laboratory, EPA Corvallis, OR **ORDER FROM: NTIS-PB** 264 922 $4.00 EPA CONTACT: Witherow, J. L.

600/2-76-260 **SIC 301 MISCELLANEOUS** **GRANT NO. 12020 GUT**

Industrial Wastewater Reclamation with a 400,000-Gallon-Per-Day Vertical Tube Evaporator BY W. C. Lang, J. H. Crozier, F. P. Drese, and K. H. Pearson, General Tire and Rubber Company Akron, OH **ORDER FROM: NTIS-PB** 265 361 $5.50 EPA CONTACT: Field, J. W.

600/2-76-269 **SIC 323 MISCELLANEOUS** **CONTRACT NO. 68-02-1323**

Source Assessment: Glass Container Manufacturing Plants BY J. R. Schorr, D. T. Hooie, P. R. Sticksel, and C. Brockway, Battelle Columbus Laboratories Columbus, OH **ORDER FROM: NTIS-PB** 262 002 EPA CONTACT: Wooldridge, E. J.

600/2-77-005 **SIC 323 MISCELLANEOUS** **CONTRACT NO. 68-02-1323**

Source Assessment: Pressed and Blown Glass Manufacturing Plants BY J. R. Schorr, D. T. Hooie, M.C. Brockway, P. [illegible] Sticksel, and D. E. Niesz, Battelle Columbus Laboratories Columbus, OH **ORDER FROM:** Pending EPA CONTACT: Denny, D. A.

600/2-77-023q **SIC 327 MISCELLANEOUS** **CONTRACT NO. 68-02-1319**

Industrial Process Profiles for Environmental Use: Chapter 17. The Gypsum and Wallboard Industry BY T. Parsons, Radian Corporation Austin, TX **ORDER FROM:** Pending EPA CONTACT: Harrington, R. E.

600/2-77-023r **SIC 327 MISCELLANEOUS** **CONTRACT NO. 68-02-1319**

Industrial Process Profiles for Environmental Use: Chapter 18. The Lime Industry BY T. Parsons, and G. E. Wilkins, Radian Corporation Austin, TX **ORDER FROM:** Pending EPA CONTACT: Harrington, R. E.

600/2-77-023s **SIC 325 MISCELLANEOUS** **CONTRACT NO. 68-02-1319**

Industrial Process Profiles for Environmental Use: Chapter 19. The Clay Industry BY T. Parsons, and G. E. Wilkins, Radian Corporation Austin, TX **ORDER FROM:** Pending EPA CONTACT: Harrington, R. E.

600/2-77-023t **SIC 329 MISCELLANEOUS** **CONTRACT NO. 68-02-1319**

Industrial Process Profiles for Environmental Use: Chapter 20. The Mica Industry BY T. Parsons, and G. E. Wilkins, Radian Corporation Austin, TX **ORDER FROM:** Pending EPA CONTACT: Harrington, R. E.

600/2-77-023u **SIC 324 MISCELLANEOUS** **CONTRACT NO. 68-02-1319**

Industrial Process Profiles for Environmental Use: Chapter 21. The Cement Industry BY J. T. Reding, P. E. Muehlberg, B. P. Shepherd, T. Parsons, and G. E. Wilkins, Radian Corporation Austin, TX **ORDER FROM:** Pending EPA CONTACT: Harrington, R. E.

600/2-77-034 **SIC 311 MISCELLANEOUS** **GRANT NO. 801037**

Leather Tannery Waste Management Through Process Change, Reuse and Pretreatment BY J. M. Constantin, and G. B. Stockman, Pfister and Vogel Tanning Company Milwaukee, WI **ORDER FROM: NTIS-PB** 264 204/AS $7.50 EPA CONTACT: Banks, W. L.

600/2-77-059 **SIC 329 MISCELLANEOUS** **GRANT NO. 802394**

Evaluation of Electron Microscopy for Process Control in the Asbestos Industry BY R. M. Gerber, and R. C. Rossi, Aerospace Corporation Los Angeles, CA **ORDER FROM:** Pending EPA CONTACT: Harris, D. B.

REPORT ABSTRACTS SECTION

600/7-76-034j SIC 324 MISCELLANEOUS CONTRACT NO. 68-02-2198

Environmental Considerations fo Selected Energy Conserving Manufacturing Process Options. Vol. X. Cement Industry Report Arthur D. Little, Inc. Cambridge, MA **ORDER FROM:** Pending EPA CONTACT: Skovronek, H. S.

600/7-76-034k SIC 321 MISCELLANEOUS CONTRACT NO. 68-02-2198

Environmental Considerations of Selected Energy Conserving Manufacturing Process Options. Vol. XI. Glass Industry Report Arthur D. Little, Inc. Cambridge, MA **ORDER FROM:** Pending EPA CONTACT: Skovronek, H. S.

650/2-74-087 SIC 329 MISCELLANEOUS CONTRACT NO. 68-02-0230

Identification and Assessment of Asbestos Emissions from Incidental Sources of Asbestos Battelle Columbus Laboratories Columbus, OH **ORDER FROM: NTIS-PB** 241 999/AS $9.50

The report describes work directed at defining the potential seriousness of asbestos emissions that result from man's disturbing geological formations in which asbestos occurs as an accessory mineral. An extensive literature search yielded a catalog of all known and probable occurrences of asbestos in the United States. These locations were screened to identify large mining activities which could cause release of asbestos to the atmosphere. Sixteen such sites were identified. Emissions were estimated for these sites, based on production figures and the nature of the operations. Two sites were selected from this group for further characterization based on probable emissions and population density considerations. Ambient air samples were taken at the two sites using high volume samplers; the samples were analyzed using electron microscope techniques. The findings are discussed. EPA CONTACT: Oestreich, D. K.

650/2-74-088 SIC 329 MISCELLANEOUS CONTRACT NO. 68-02-1353

Assessment of Particle Control Technology for Enclosed Asbestos Sources IIT Research Institute Chicago, IL **ORDER FROM: NTIS-PB** 239 926/AS $5.75

The report gives results of a study to provide information, from both the literature and user contact, on the control of asbestos emissions from enclosed sources. It assesses the state-of-the-art in asbestos emission control in terms of the devices or methods used and their efficiency. In addition, it gives results of a preliminary study to actually measure the effectiveness of baghouse control devices in controlling emissions from five asbestos plants. Baghouses are the predominant control device used in the asbestos industry. Cotton bags are used most frequently. Automatic shaking is used in most baghouses. Published data on the removal efficiencies of the control devices was either non-existent or quoted in general terms. Five baghouses were tested for removal efficiency in terms of mass and fiber number. Using computer modeling, it was found that even considering one source, asbestos concentrations of 500 f/cu. meter can be anticipated 5 km from the source. The exposure level at which asbestos in ambient air becomes a health hazard is not know. EPA CONTACT: Oestreich, D. K.

650/2-74-090 SIC 329 MISCELLANEOUS CONTRACT NO. 68-02-1348

Characterization and Control of Asbestos Emissions from Open Sources IIT Research Institute Chicago, IL **ORDER FROM: NTIS-PB** 238 925/AS $7.25

The report reviews control technology applicable to asbestos emissions from open sources including asbestos mines, mills, and manufacturing waste piles. It combined a literature review with visits to asbestos mining and manufacturing operations, and considered climatology, location, and topography. The study, which included preliminary field sampling, produced a comprehensive bibliography on emissions control. The health effects of asbestos exposure were reviewed from two aspects: the significant of fiber size, and the effect of non-occupational exposure. Fiber size considered to be most harmful is still not established and, while non-occupational exposure probably does not lead to asbestosis, evidence relates it to increased incidence of cancer. Data analysis indicated that asbestos can be detected at considerable distances from a given source. It was concluded that, because of their proximity to populations, asbestos manufacturing waste piles are a threat to public health more serious than asbestos mining. EPA CONTACT: Oestreich, D. K.

REPORT ABSTRACTS SECTION

650/2-74-122 SIC 324 MISCELLANEOUS CONTRACT NO. 68-02-1321

Trace Pollutant Emissions from the Processing of Non-Metallic Ores PEDCo-Environmental Specialists, Inc. Cincinnati, OH **ORDER FROM: NTIS-PB** 240 117/AS $8.75

The report gives results of a study to identify significant sources of emissions of potentially hazardous trace pollutants from mining and processing of non-metallic minerals. Based on a review of domestic ore processing data and consideration of both the toxicity of potential pollutants and the significance of fugitive dust emissions, the following nine industries were selected for further study: cement, clay (including porcelain, refractory, and brick), gypsum, lime, phosphate rock (including fertilizer), potash, boron, mica, and fluorspar. Provided for each of the nine industries are process flow diagrams identifying major processes and material flow, identification of sources of emissions of various pollutants, and process descriptions. The report recommends that five processes be further evaluated because of their potential for emissions of hazardous pollutants or fugitive dust: kiln (cement and lime industries), phosphate rock mining and washing, clay mining, hydrator (thermal phosphoric acid production), and reactor (wet-process phosphoric acid production). EPA CONTACT: Oestreich, D. K.

650/2-75-036 SIC 329 MISCELLANEOUS GRANT NO. 801336

Asbestos Fiber Atlas California Department of Health Berkeley, CA **ORDER FROM: NTIS-PB** 244 766 $4.25

650/2-75-058a SIC 329 MISCELLANEOUS CONTRACT NO. 68-02-1496

Johns-Manville CHEAF Evaluation Air Pollution Technology, Inc. San Diego, CA **ORDER FROM: NTIS-PB** 256 311 EPA CONTACT: Hanson, D. L.

660/2-74-040 SIC 328 MISCELLANEOUS GRANT NO. 12080 GCH

Granite Industry Wastewater Treatment BY W. B. Farnham, Vermont, State of, Department of Water Resources Montpelier, VT **ORDER FROM: NTIS-PB** 235 505

A study of wastewater discharge in the granite industry has been conducted to determine wastewater characteristics, methods of pollution abatement and disposal methods for waste granite sludge. The project included a study of overall water use in a granite plant, water optimization studies, and water reduction studies. Laboratory testing was conducted for waste characterization and liquid solids separation techniques. A pilot plant was designed, constructed and operated to test the efficiency of plant scale separation procedures. A prototype plant was designed and constructed to test the possibility of complete water reuse in the granite industry. Successful operation of both plants indicates that a practical method of treating granite waste effluent has been developed and that complete recycle of treated effluent is possible and economically feasible.

660/2-74-066 SIC 328 MISCELLANEOUS IN-HOUSE PROJECT

State of the Art: Sand and Gravel Industry BY B. D. Newport, and J. E. Moyer, Robert S. Kerr Environmental Research Laboratory Ada, OK **ORDER FROM: NTIS-PB** 236 147 $2.85

670/2-75-043 SIC 324 MISCELLANEOUS GRANT NO. 801872

Disposal and Utilization of Waste Kiln Dust From Cement Industry BY T. A. Davis, and D. B. Hooks, Southern Research Institute Birmingham, AL **ORDER FROM: NTIS-PB** 242 825/AS $4.25

A survey that included 60% of the cement-manufacturing plants in the United States was made to determine the fate of dust collected from the gases emanating from cement kilns. Because of high alkali content, large quantities of the dust cannot be returned to the cement-making process. A survey was made of the literature in the United States and Europe pertaining to handling, reclaiming, and utilizing the collected dust. Abstracts of 71 references are included in the Appendix. Acid neutralization capacity and potash content make the dust valuable for application to farmland, and the potential market for agricultural use alone could consume all of the waste dust that is now being discarded. EPA CONTACT: Wilson, D.

600/1-77-003 SIC 333 NON-FERROUS METALS CONTRACT NO. 68-02-1226

Copper National Academy of Sciences Washington, DC **ORDER FROM: NTIS-PB** 262 425 $7.50 EPA CONTACT: Stopinski, O. W.

REPORT ABSTRACTS SECTION

600/2–75–028 SIC 347 NON-FERROUS METALS GRANT NO. 12010 GUB

Electrolytic Treatment of Job Shop Metal Finishing Wastewater BY B. E. Warner, New England Plating Company, Inc. Worcester, MA **ORDER FROM: NTIS-PB** 246 560/AS $6.75

Full scale in-plant production studies demonstrated the reliability and economics of electrolytic cells containing beds of conductive particles between cathodes and anodes for reduction of hexavalent chromium and oxidation of cyanide in plating rinse water. The heavy metals are subsequently removed from the waste water by alkali precipitation. Seventy-five liter/min. (20 GPM) sized cells were employed for chromium and cyanide rinses. Chromium concentrations to 250 mg/liter and cyanide concentrations to 150 mg/liter were processed. Data were obtained with parallel equipment using chemical treatment for cost comparison. Waste treatment costs, capital and operating, for the job shop are provided with an assessment of total costs on the price of services provided. Water conservation techniques are described. Experiences with tube settling equipment for removal of suspended solids and centrifuge for sludge concentration is provided. EPA CONTACT: Ciancia, J.

600/2–76–008 SIC 333 NON-FERROUS METALS CONTRACT NO. 68–02–4191

SO$_2$ Control Processes for Non-Ferrous Smelters BY J. C. Mathews, F. L. Bellegia, C. H. Gooding, and G. E. Weant, Research Triangle Institute Research Triangle Park, NC **ORDER FROM: NTIS-PB** 251 409/AS $10.75

The report reviews and evaluates a number of adsorption-based SO$_2$ control systems and the application of these control systems to those U.S. primary copper smelters which generate weak SO$_2$-containing gas streams. Capital and operating cost relationships have been developed for each specific process, covering a range of gas flows and SO$_2$ concentrations. Separate general costs for gas pretreatment and the end-of-the-line SO$_2$ utilization facilities (i.e., surfuric acid, elemental sulfur, and liquid SO$_2$ plants) are also provided. The 13 U.S. primary copper smelters which currently still generate weak SO$_2$ streams have been reviewed with reference to their current operation and active programs in hand to control or eliminate weak SO$_2$ streams. Appropriate SO$_2$ control processes have been matched with the individual smelters and related capital and operating costs have been developed from the earlier established cost relationships. EPA CONTACT: Kemnitz, D. A.

600/2–76–011 SIC 347 NON-FERROUS METALS IN-HOUSE PROJECT

Thor V Solventless Metal Decorating for Three-Piece Cans— Background BY J. W. Capron, and R. C. Heininger, Continental Can Corporation Chicago, IL **ORDER FROM: NTIS-PB** 249 484/AS $3.50

The report gives the background of a demonstration project to develop and commercialize the Thor V process to apply and cure an outside, protective/decorative, UV-cured white base coating on flat sheets used for the bodies of three-piece cans. The Thor V process is a single-pass line: the UV white coating is applied and UV-cured to a printable condition; and two conventional inks and a trailing varnish are applied, followed by baking in a gas-fired wicket oven. The conventional process is a two-line operation: one line applies the white coating, followed by the oven bake: the other applies the two inks and varnish, again followed by an oven bake. The Thor V process reduces total line length by 215 ft (615M) and total solvent emissions by about 66%, compared to the conventional process. Elimination of an oven and after-burner also reduces new equipment costs by over $400,000 and saves about 8 million Btu/hr (2 million Cal/hr) in gas consumption. The report also reviews development work to date, describes the Thor V line at a plant in Weirton, West Virginia, and describes work needed to complete the project. EPA CONTACT: Wooldridge, E. J.

600/2–76–036a SIC 333 NON-FERROUS METALS CONTRACT NO. 68–02–1405

Design and Operating Parameters for Emission Control Studies: White Pine Copper Smelter BY I. J. Weisenberg, and J. C. Serne, Pacific Environmental Services, Inc. Santa Monica, CA **ORDER FROM: NTIS-PB** 251 754/AS $4.00

The report gives background design data for a specific copper smelter. The data is sufficiently detailed to allow air pollution control system engineering studies to be conducted. These studies will be concerned primarily with lean SO$_2$ streams that currently are not being captured. Physical layout of the smelter and the surrounding area is presented, along with existing control equipment. Ductwork that would be considered for future system tie-in is defined. Emissions from operating equipment, gas flow rates, temperatures, sulfur balance, and a process flow sheet are included. Utilities, stack dimensions, footing requirements, and solid waste handling are defined. Available area for new control equipment, gas characteristic variation, and potential new control equipment installation problems are discussed. Portions of this document are not fully legible. EPA CONTACT: Rovang, R.

600/2–76–036b SIC 333 NON-FERROUS METALS CONTRACT NO. 68–02–1405

Design and Operating Parameters for Emission Control Studies: Kennecott, Hayden, Copper Smelter BY I. J. Weisenberg, and J. C. Serne, Pacific Environmental Services, Inc. Santa Monica, CA **ORDER FROM: NTIS-PB** 251 755/AS $4.50

The report gives background design data for a specific copper smelter. The data is sufficiently detailed to allow air pollution control system engineering studies to be conducted. These studies will be concerned primarily with lean SO$_2$ streams that currently are not being captured. Physical layout of the smelter and the surrounding area is presented, along with existing control equipment. Ductwork that would be considered for future system tie-in is defined. Emissions from operating equipment, gas flow rates, temperatures, sulfur balance, and a process flow sheet are included. Utilities, stack dimensions, footing requirements and solid waste handling are defined. Available area for new control equipment, gas characteristic variation, and potential new control equipment installation problems are discussed. EPA CONTACT: Rovang, R.

REPORT ABSTRACTS SECTION

600/2-76-036c SIC 333 NON-FERROUS METALS CONTRACT NO. 68-02-1405

Design and Operating Parameters for Emission Control Studies: Kennecott, McGill, Copper Smelter BY I. J. Weisenberg, and J.C. Serne, Pacific Environmental Services, Inc. Santa Monica, CA **ORDER FROM: NTIS-PB** 251 756/AS $4.00

The report gives background design data for a specific copper smelter. The data is sufficiently detailed to allow air pollution control system engineering studies to be conducted. These studies will be concerned primarily with lean SO_2 streams that currently are not being captured. Physical layout of the smelter and the surrounding area is presented, along with existing control equipment. Ductwork that would be considered for future system tie-in is defined. Emissions from operating equipment, gas flow rates, temperatures, sulfur balance, and a process flow sheet are included. Utilities, stack dimensions footing requirements, and solid waste handling are defined. Available area for new control equipment, gas characteristic variation, and potential new control equipment installation problems are discussed. EPA CONTACT: Rovang, R.

600/2-76-036d SIC 333 NON-FERROUS METALS CONTRACT NO. 68-02-1405

Design and Operating Parameters for Emission Control Studies: Kennecott, Hurley, Copper Smelter BY I. J. Weisenberg, and J. C. Serne, Pacific Environmental Services, Inc. Santa Monica, CA **ORDER FROM: NTIS-PB** 251 757/AS $4.00

The report gives background design data for a specific copper smelter. The data is sufficiently detailed to allow air pollution control system engineering studies to be conducted. These studies will be concerned primarily with lean SO_2 streams that currently are not being captured. Physical layout of the smelter and the surrounding area is presented, along with existing control equipment. Ductwork that would be considered for future system tie-in is defined. Emissions from operating equipment, gas flow rates, temperatures, sulfur balance, and a process flow sheet are included. Utilities, stack dimensions, footing requirements, and solid waste handling are defined. Available area for new control equipment, gas characteristic variation, and potential new control equipment installation problems are discussed. EPA CONTACT: Rovang, R.

600/2-76-036e SIC 333 NON-FERROUS METALS CONTRACT NO. 68-02-1405

Design and Operating Parameters for Emission Control Studies: Magma, San Manuel, Copper Smelter BY I. J. Weisenberg, and J. C. Serne, Pacific Environmental Services, Inc. Santa Monica, CA **ORDER FROM: NTIS-PB** 251 758/AS $4.00

The report gives background design data for a specific copper smelter. The data is sufficiently detailed to allow air pollution control system engineering studies to be conducted. These studies will be concerned primarily with lean SO_2 streams that currently are not being captured. Physical layout of the smelter and the surrounding area is presented, along with existing control equipment. Ductwork that would be considered for future system tie-in is defined. Emissions from operating equipment, gas flow rates, temperatures, sulfur balance, and a process flow sheet are included. Utilities, stack dimensions, footing requirements, and solid waste handling are defined. Available area for new control equipment, gas characteristic variation, and potential new control equipment installation problems are discussed. EPA CONTACT: Rovang, R.

600/2-76-036f SIC 333 NON-FERROUS METALS CONTRACT NO. 68-02-1405

Design and Operating Parameters for Emission Control Studies: Phelps Dodge, Ajo, Copper Smelter BY I. J. Weisenberg, and J. C. Serne, Pacific Environmental Services, Inc. Santa Monica, CA **ORDER FROM: NTIS-PB** 251 759/AS $4.50

The report gives background design data for a specific copper smelter. The data is sufficiently detailed to allow air pollution control system engineering studies to be conducted. These studies will be concerned primarily with lean SO_2 streams that currently are not being captured. Physical layout of the smelter and the surrounding area is presented, along with existing control equipment. Ductwork that would be considered for future system tie-in is defined. Emissions from operating equipment, gas flow rates, temperatures, sulfur balance, and a process flow sheet are included. Utilities, stack dimensions, footing requirements, and solid waste handling are defined. Available area for new control equipment, gas characteristic variation, and potential new control equipment installation problems are discussed. EPA CONTACT: Rovang, R.

600/2-76-036g SIC 333 NON-FERROUS METALS CONTRACT NO. 68-02-1405

Design and Operating Parameters for Emission Control Studies: Phelps Dodge, Morenci, Copper Smelter BY I. J. Weisenberg, and J. C. Serne, Pacific Environmental Services, Inc. Santa Monica, CA **ORDER FROM: NTIS-PB** 251 760/AS $3.50

The report gives background design data for a specific copper smelter. The data is sufficiently detailed to allow air pollution control system engineering studies to be conducted. These studies will be concerned primarily with lean SO_2 streams that currently are not being captured. Physical layout of the smelter and the surrounding area is presented, along with existing control equipment. Ductwork that would be considered for future system tie-in is defined. Emissions from operating equipment, gas flow rates, temperatures, sulfur balance, and a process flow sheet are included. Utilities, stack dimensions, footing requirements, and solid waste handling are defined. Available area for new control equipment, gas characteristic variation, and potential new control equipment installation problems are discussed. EPA CONTACT: Rovang, R.

REPORT ABSTRACTS SECTION

600/2-76-036h SIC 333 NON-FERROUS METALS CONTRACT NO. 68-02-1405

Design and Operating Parameters for Emission Control Studies: Phelps Dodge, Douglas, Copper Smelter BY I. J. Weisenberg, and J. C. Serne, Pacific Environmental Services, Inc, Santa Monica, CA **ORDER FROM:** NTIS-PB 251 761/AS $4.00

The report gives background design data for a specific copper smelter. The data is sufficiently detailed to allow air pollution control system engineering studies to be conducted. These studies will be concerned primarily with lean SO_2 streams that currently are not being captured. Physical layout of the smelter and the surrounding area is presented, along with existing control equipment. Ductwork that would be considered for future system tie-in is defined. Emissions from operation equipment, gas flow rates, temperatures, sulfur balance, and a process flow sheet are included. Utilities, stack dimensions, footing requirements, and solid waste handling are defined. Available area for new control equipment, gas characteristic variation, and potential new control equipment installation problems are discussed. EPA CONTACT: Rovang, R.

600/2-76-036i SIC 333 NON-FERROUS METALS CONTRACT NO. 68-02-1405

Design and Operating Parameters for Emission Control Studies: ASARCO, El Paso, Copper Smelter BY I. J. Weisenberg, and J. C. Serne, Pacific Environmental Services, Inc. Santa Monica, CA **ORDER FROM:** NTIS-PB 251 762/AS $4.00

The report gives background design data for a specific copper smelter. The data is sufficiently detailed to allow air pollution control system engineering studies to be conducted. These studies will be concerned primarily with lean SO_2 streams that currently are not being captured. Physical layout of the smelter and the surrounding area is presented, along with existing control equipment. Ductwork that would be considered for future system tie-in is defined. Emissions from operating equipment, gas flow rates, temperatures, sulfur balance, and a process flow sheet are included. Utilities, stack dimensions, footing requirements, and solid waste handling are defined. Available area for new control equipment, gas characteristic variation, and potential new control equipment installation problems are discussed. EPA CONTACT: Rovang, R.

600/2-76-036j SIC 333 NON-FERROUS METALS CONTRACT NO. 68-02-1405

Design and Operating Parameters for Emission Control Studies: ASARCO, Hayden, Copper Smelter BY I. J. Weisenberg, and J. C. Serne, Pacific Environmental Services, Inc. Santa Monica, CA **ORDER FROM:** NTIS-PB 251 763/AS $4.00

The report gives background design data for a specific copper smelter. The data is sufficiently detailed to allow air pollution control system engineering studies to be conducted. These studies will be concerned primarily with lean SO_2 streams that currently are not being captured. Physical layout of the smelter and the surrounding area is presented, along with existing control equipment. Ductwork that would be considered for future system tie-in is defined. Emissions from operating equipment, gas flow rates, temperatures, sulfur balance, and a process flow sheet are included. Utilities, stack dimensions, footing requirements, and solid waste handling are defined. Available area for new control equipment, gas characteristic variation, and potential new control equipment installation problems are discussed. EPA CONTACT: Rovang, R.

600/2-76-036k SIC 333 NON-FERROUS METALS CONTRACT NO. 68-02-1405

Design and Operating Parameters for Emission Control Studies: ASARCO, Tacoma, Copper Smelter BY I. J. Weisenberg, and J. C. Serne, Pacific Environmental Services, Inc. Santa Monica, CA **ORDER FROM:** NTIS-PB 251 764/AS $4.00

The report gives background design data for a specific copper smelter. The data is sufficiently detailed to allow air pollution control system engineering studies to be conducted. These studies will be concerned primarily with lean SO_2 streams that currently are not being captured. Physical layout of the smelter and the surrounding area is presented, along with existing control equipment. Ductwork that would be considered for future system tie-in is defined. Emissions from operating equipment, gas flow rates, temperatures, sulfur balance, and a process flow sheet are included. Utilities, stack dimensions, footing requirements, and solid waste handling are defined. Available area for new control equipment, gas characteristic variation, and potential new control equipment installation problems are discussed. Portions of this document are not fully legible. EPA CONTACT: Rovang, R.

600/2-76-197 SIC 347 NON-FERROUS METALS GRANT NO. 803264-01-

New Membranes for Treating Metal Finishing Effluents by Reverse Osmosis BY R. J. Petersen, and K. E. Cobian, Midwest Research Institute Minneapolis, MN **ORDER FROM:** NTIS-PB 265 363 $4.50 EPA CONTACT: Wilson, D. L.

REPORT ABSTRACTS SECTION

600/2-76-199 SIC 334 NON-FERROUS METALS CONTRACT NO. 68-02-1325

Operation of a Sulfuric Acid Plant Using Blended Copper Smelter Gases BY B. H. Carpenter, Research Triangle Institute Research Triangle Park, NC **ORDER FROM: NTIS-PB** 258 649/as $4.50

A high degree of control of SO_x emissions at copper smelters can be obtained by blending reverberatory furnace gases with gases from roasters and converters and using the combined stream as feed to a sulfuric acid plant. The Bor Copper Smelter in Bor, Yugoslavia, experimented with this technique for a short time and reported that visible plumes of acid mist were emitted from their acid plant stack. This was attributed to the carbon dioxide present in the reverb gases, which was presumed to decrease the absorption of SO_3 with the unabsorbed SO_3 emitted as a mist. The results of this study indicate that the visible plume produced at the acid plant at Bor, Yugoslavia, when reverberatory furnace gases were added to its feed stream were caused by factors other than the presence of CO_2. The visible plume could most likely have resulted from additional sulfuric acid mist loads imposed upon the wet electrostatic precipitator (ESP) that receives cooled smelter gases from the acid plant cooling system. Factors which could have increased the mist content of the blended gases when the reverberatory furnace gases were included are discussed. EPA CONTACT: Hendricks, R. V.

600/2-76-261 SIC 347 NON-FERROUS METALS GRANT NO. 800945-01

Treatment of Electroplating Wastes by Reverse Osmosis BY R. G. Donnelly, R. L. Goldsmith, K. J. McNulty, D. C. Grant, and M. Tan, American Electroplaters' Society East Orange, NJ **ORDER FROM: NTIS-PB** 265 393 $5.50 EPA CONTACT: Ciancia, J.

600/2-76-296 SIC 347 NON-FERROUS METALS GRANT NO. 803242-01

Metal Removal and Cyanide Destruction in Plating Wastewaters Using Particle Bed Electrodes **BY W. Chen, H. L. Recht, and G. P. Hajela, Rockwell International Corporation Canoga Park, CA** ORDER FROM: NTIS-PB **266 138 $4.50 EPA CONTACT: Ellerbusch, F.**

600/2-76-301 SIC 333 NON-FERROUS METALS GRANT NO. 803760

Assessment of Technology for Possible Utilization of Bayer Process Muds BY B. K. Parekh, and W. M. Goldberger, Battelle Memorial Institute Columbus, OH **ORDER FROM:** Pending EPA CONTACT: Wilson, D.

600/2-76-303 SIC 333 NON-FERROUS METALS CONTRACT NO. 68-02-1323

Methodology for Assessing Environmental Implications and Technologies: Nonferrous Metals Industries BY E. S. Bartlett, and R. A. Wood, Battelle Columbus Laboratories Columbus, OH **ORDER FROM: NTIS-PB** 265 476 $5.00 EPA CONTACT: Stasikowski, M.

600/2-77-023y SIC 333 NON-FERROUS METALS CONTRACT NO. 68-02-1319

Industrial Process Profiles for Environmental Use: Chapter 25. Primary Aluminum Industry BY T. Parsons, Radian Corporation Austin, TX **ORDER FROM:** Pending EPA CONTACT: Harrington, R. E.

600/2-77-023z SIC 333 NON-FERROUS METALS CONTRACT NO. 68-02-1319

Industrial Process Profiles for Environmental Use: Chapter 26. Titanium Industry BY V. S. Katari, T. W. Devitt, and T. B. Parsons, Radian Corporation Austin, TX **ORDER FROM:** Pending EPA CONTACT: Harrington, R. E.

600/2-77-038 SIC 347 NON-FERROUS METALS GRANT NO. 803265-01

Zinc Sludge Recycling After Kastone-R Treatment of Cyanide-Bearing Rinse Water BY J. G. Moser, Metal Plating Corporation Connersville, IN **ORDER FROM:** Pending EPA CONTACT: Wilson, D. L.

600/2-77-039 SIC 347 NON-FERROUS METALS GRANT NO. 803753

Reverse Osmosis Field Test: Treatment of Watts Nickel Rinse Waters BY J. K. McNulty, R. L. Goldsmith, and A. Z. Gollan, Abcor, Inc., Walden Research Division Wilmington, MA **ORDER FROM:** Pending EPA CONTACT: Stinson, M.

600/2-77-049 SIC 347 NON-FERROUS METALS GRANT NO. 802924

Treatment of Metal Finishing Wastes by Sulfide Precipitation BY R. M. Schlauch, and A. C. Epstein, Permutit Company Princeton, NJ **ORDER FROM:** Pending EPA CONTACT: Wilson, D.

REPORT ABSTRACTS SECTION

600/2-77-072 SIC 347 NON-FERROUS METALS GRANT NO. 803564

Foam Flotation Treatment of Heavy Metals and Fluoride-Bearing Industrial Wastewaters BY D. J. Wilson, Vanderbilt University Nashville, TN **ORDER FROM:** Pending EPA CONTACT: Wilson, D.

600/7-76-034h SIC 333 NON-FERROUS METALS CONTRACT NO. 68-02-2198

Environmental Considerations of Selected Energy Conserving Manufacturing Process Options. Vol. VIII. Alumina/Aluminum Industry Report Arthur D. Little, Inc. Cambridge, MA **ORDER FROM: NTIS-PB** 264 274 $6.75 EPA CONTACT: Skovronek, H. S.

600/7-76-034n SIC 333 NON-FERROUS METALS CONTRACT NO. 68-02-2198

Environmental Considerations of Selected Energy Conserving Manufacturing Process Options. Vol. XIV. Primary Copper Industry Report Arthur D. Little, Inc Cambridge, MA **ORDER FROM: NTIS-PB** 264 280 $6.00 EPA CONTACT: Skovronek, H. S.

650/2-74-085a SIC 333 NON-FERROUS METALS CONTRACT NO. 68-02-0825

Control of Sulfur Dioxide Emissions from Copper Smelters: Volume I – Steam Oxidation of Pyritic Copper Concentrates Battelle Pacific Northwest Laboratories Richland, WA **ORDER FROM: NTIS-PB** 237 748/AS $4.75

The report presents results of a laboratory study on production of hydrogen sulfide by reaction between water vapor at 700–800C and iron sulfide contained in neutral-roasted pyritic copper ore concentrate. Hydrogen sulfide thus obtained was to be reacted with sulfur dioxide emitted from copper smelter converters. In this manner sulfur emissions from a smelter could be controlled and recovered in the form of elemental sulfur. It was determined that the above treatment of copper ore concentrate could yield necessary quantities of hydrogen sulfide. The concentration of yielded hydrogen sulfide, however, was limited in the stream to less than 1.0 percent by reaction equilibrium conditions, thus implying excessively high energy requirements and causing this control approach to be significantly more expensive than known conventional processes. Alternative means of hydrogen sulfide production are dealt with in the second volume of the report. EPA CONTACT: Stankus, L.

650/2-74-085b SIC 333 NON-FERROUS METALS CONTRACT NO. 68-02-1306

Control of Sulfur Dioxide Emissions from Copper Smelters: Volume II – Hydrogen Sulfide Production from Copper Concentrates Battelle Pacific Northwest Laboratories Richland, WA **ORDER FROM: NTIS-PB** 237 928/AS $5.25

A laboratory investigation has been made of a modified copper smelting process which provides a solution to the sulfur dioxide air pollution problem. Preliminary economic evaluation of the process appears favorable with good prospects for further improvements when compared with conventional processes provided with equivalent air pollution abatement capabilities. The process would involve (1) neutral roasting of pyritic copper concentrates to convert the contained iron into an acid-soluble form with evolution of some elemental sulfur in this step, (2) hydrochloric acid leaching of the roasted concentrate to dissolve the iron with simultaneous hydrogen sulfide generation and production of an enriched copper sulfide residue, (3) converting the copper sulfide residue to blister copper by conventional means, (4) reducing the sulfur dioxide formed in the converting step to elemental sulfur with hydrogen sulfide from the leaching step, and (5) processing the iron chloride leach solution to regenerate hydrochloric acid and to yield a marketable iron oxide. EPA CONTACT: Stankus, L.

650/2-74-100 SIC 333 NON-FERROUS METALS CONTRACT NO. 68-02-1323

Process Modifications for Control of Particulate Emissions from Stationary Combustion, Incineration, and Metals Battelle Columbus Laboratories Columbus, OH **ORDER FROM: NTIS-PB** 237 422 $5.25

The report summarizes the state of process modifications relative to the control of fine particulate emissions from stationary combustion sources (electric utilities and industrial processes); municipal incinerators; iron and steel plants; ferro-alloy plants; and nonferrous metal smelters (zinc plants, copper smelters, aluminum reduction cells). Modifications to conventional stationary combustion sources considered include ash fluxing, SO_3 addition to flue gas, staged combustion, use of fuel additives, fly-ash agglomeration, solvent refining, and flue-gas recirculation. Unconventional systems studied include fluidized bed, coal gasification, and submerged combustion. For incinerators, combined fuel-refuse firing, gas cooling, and pyrolysis methods are considered. Emphasis for iron and steel plants is given to the bottom-blowing oxygen process (Q-BOP). Modification of the conventional reverberatory smelting procedure and the introduction of hydrometallurgical methods are discussed for copper, and chloride electrolytic (ASP) process by ALCOA is considered for aluminum. EPA CONTACT: Foley, G. J.

REPORT ABSTRACTS SECTION

650/2-74-111 SIC 333 NON-FERROUS METALS IN-HOUSE PROJECT

Measurement of Sulfur Dioxide, Particulate, and Trace Elements in Copper Smelter Converter and Roaster/Reverberatory Gas Streams Research Triangle Institute Research Triangle Park, NC **ORDER FROM: NTIS-PB 238 095/AS $4.75**

The report gives the results of the analysis of data on particulate, sulfur dioxide (SO_2) and trace element emissions and control efficiencies for a copper smelter. The SO_2 emission rates from the roaster/reverberatory and converter effluent streams were 518 and 587 lb/min, respectively. The acid plant's SO_2 control efficiency was 96.8 percent. The mass collection efficiency of the converter's electrostatic precipitator (ESP) for dry filterable solids was 95 percent. Analyzing emitted particulates gave the following mass emission rates (in lb/hr) for selected elements: arsenic (58.5), lead (24.65), cadmium (1.32), zinc (15.7), chromium (0.060), and copper (4.825). Control efficiency for the analyzed elements was between 90 and 98 percent. EPA CONTACT: Statnick, R. M.

650/2-74-115 SIC 333 NON-FERROUS METALS CONTRACT NO. 68-02-1321

Trace Pollutant Emissions from the Processing of Metallic Ores PEDCo-Environmental Specialists, Inc. Cincinnati, OH **ORDER FROM: NTIS-PB 238 655/AS $8.75**

The report gives results of a study of eight metallic ore processing industries. Selected for their potential for hazardous pollutant emissions, the industries were: iron and steel ferroalloy, primary copper, primary lead, primary zinc, aluminum, titanium, and uranium. Bases for selection were: quantity of ore processed, toxicity of potential emissions, fugitive dust emissions potential and process characteristics. The report describes the processes in each industry in terms of a functional process statement, process operating conditions, energy requirements, potential emissions, and method of transferring material from one process to the next. Eleven processes are recommended for more detailed study because of their significant hazardous pollutant emissions potential. EPA CONTACT: Oestreich, D. K.

650/2-74-131 SIC 333 NON-FERROUS METALS CONTRACT NO. 68-02-0226

Determination of Hazardous Elements in Smelter-Produced Sulfuric Acid Monsanto Research Corporation Dayton, OH **ORDER FROM: NTIS-PB 240 343/AS $4.25**

The report presents results of analyses of potentially hazardous impurities (trace elements) in sulfuric acid produced by nonferrous smelters. Sulfuric acid samples were obtained from acid plants attached to copper, lead, and zinc smelters. Results of analyses provided by some smelters are also included. Trace elements subjected to qualitative and quantitative determinations in this study include: Pb, Cu, Zn, Hg, As, Cd, Se, Sb, and Be, as well as other elements detected in significant concentrations during screening tests. Based on this analytical data, the report indicates yearly outputs of hazardous trace elements contained in smelter-produced acid for possible consumption in a variety of industries. The report also presents information on analytical methods and procedures used in acquiring the reported data. EPA CONTACT: Stankus, L.

650/2-75-019a SIC 347 NON-FERROUS METALS CONTRACT NO. 68-02-1320

Source Assessment Prioritization of Air Pollution from Industrial Surface Coating Operations Monsanto Research Corporation Dayton, OH **ORDER FROM: NTIS-PB 243 423/AS $9.25**

Industrial surface coating operations, excluding those associated with automobile and architectural painting, are used in the coating of sheet, strip, coil, paper and paperboard, in treating fabrics, and in finishing appliances, machinery and furniture. These coating operations produce hydrocarbon emissions, primarily solvents and resins, and particulate emissions. Background information and technical data were collected and analyzed in this study in order to establish a data base for prioritizing atmospheric emissions from industrial surface coating operations, excluding automobile and architectural painting. This special project was undertaken to provide information on solvent evaporation processes required by the EPA for use in establishing New Source Performance Standards for industrial surface coating operations. EPA CONTACT: Denny, D. A.

650/2-75-032b SIC 339 NON-FERROUS METALS CONTRACT NO. 68-02-1329

Energy Consumption: The Primary Metals and Petroleum Industries Dow Chemical Company Freeport, TX **ORDER FROM: NTIS-PB 241 990 $4.50** EPA CONTACT: Jefcoat, I. A.

660/2-73-033 SIC 334 NON-FERROUS METALS GRANT NO. 12070 HEK

Regeneration of Chromated Aluminum Deoxidizers BY H. C. Hicks, and R. A. Jarmuth, Boeing Commercial Airplane Company Seattle, WA **ORDER FROM: NTIS-PB 231 835/AS $4.25**

In the metal finishing industry highly concentrated hexavalent chromium solutions are used extensively to deoxidize aluminum surfaces prior to anodizing, conversion coatings, prepaint preparation, welding and adhesive bonding. A regeneration process was conceived and tested to reduce the frequency of discarding the spent chromated deoxidizers. The engineering techniques developed in this project involve reoxidation of trivalent chromium to the hexavalent state by electrolysis thru a diaphragm plus removal of undesirable dissolved metals by crystallization and separation. Results of the accomplished work establish that regeneration of chromated aluminum deoxidizers is feasible, practical and economical. EPA CONTACT: Durham, H. B.

REPORT ABSTRACTS SECTION

660/2-73-024 SIC 333 NON-FERROUS METALS GRANT NO. [illegible]

Treatment and Recovery of Fluoride Industrial Waste BY C. J. Staebler Jr., Grumman Aerospace Corporation Bethpage, NY **ORDER FROM: NTIS-PB 234 447**

The development and successful demonstration of laboratory and pilot-scale fluoride treatment techniques for selected aerospace and metalworking industry chemical processing solutions and rinse waters are described. Included are laboratory-scale, lime treatment parameters for chemical processing solutions such as temperature, retention time, pH, slurry concentration and fluoride influent and effluent levels, and ion-exchange treatment to reduce the fluoride concentration of rinse waters to levels less than three parts per million. Pilot studies of centrifugal techniques to separate lime-precipitated bridges from titanium chemical milling, titanium descaling and aluminum deoxidizing solutions show that lime precipitation can give final effluents having fluoride concentrations less than three parts per million. Chemical and mechanical property tests show that it is potentially feasible to use calcium fluoride sludge as a strength-maintaining additive for concrete. The reuse of treated rinse waters, the economics of precipitation, and production plans for chemical processing solutions and rinse waters are also presented.

660/2-73-033 SIC 347 NON-FERROUS METALS GRANT NO. 12010 DRH

New Membranes for Reverse Osmosis Treatment of Metal Finishing Effluents BY L. T. Rozelle, C. V. Kopp Jr., and K. E. Cobian, North Star Research Corporation Minneapolis, MN **ORDER FROM: NTIS-PB 240 722/AS $4.75**

An important new membrane has been developed for the reverse osmosis treatment of both highly alkaline and acidic (non-oxidizing) metal finishing rinse waters. This membrane designated NS-1, and originally developed for seawater desalination, consists of the following: a microporous support film (polysulfone) coated with polyethylenimine which is crosslinked with tolylene 2,4-diisocyanate. Simulated alkaline copper and zinc cyanide plating rinses at pH's of 11.8 and 12.9 were treated by NS-1 membranes during 300 and 340 hour tests without deterioration of reverse osmosis properties. Water fluxes about 10 gallons per square foot (of membrane) per day (gfd) were observed with cyanide rejections between 95 and 99 percent. The NS-1 membrane also treated simulated copper sulfate rinse waters effectively at pH 0.5 during 550-hour tests without deterioration of reverse osmosis properties (fluxes above 10 gfd with 99.8 percent rejection of copper). Preliminary engineering considerations indicated the feasibility of applying the NS-1 membrane to reverse osmosis treatment and recycle of nickel and zinc cyanide electroplating rinse waters. EPA CONTACT: Durham, H. B.

670/2-74-008 SIC 334 NON-FERROUS METALS GRANT NO. 802284

Metallic Recovery From Waste Waters Utilizing Cementation BY O. P. Case, Anaconda American Brass Company Waterbury, CT **ORDER FROM: NTIS-PB 233 143**

The report presents the results of a series of bench-scale experiments using the so-called "cementation" reaction (i.e. electrochemical reduction by contact with a metal of higher oxidation potential) for the precipitation of copper and the reduction of hexavalent chromium in industrial waste streams such as brass mill and metal finishing discharges. Reductants studied included soft iron shot, particulate iron, and silicon alloys in granular form. The bulk of the work was done using the iron shot as a reductant. Studies were carried out by both a batch process and a continuous process (black-mix reactor). Results were evaluated in terms of percent reduction, dissolution of excess iron and change in pH vs time. (Modified author abstract) EPA CONTACT: Tabakin, R. B.

670/2-74-042 SIC 347 NON-FERROUS METALS GRANT NO. 12010 DSA

Waste Water Treatment and Reuse in a Metal Finishing Job Shop S.K. Williams Company Wauwatosa, WI **ORDER FROM: NTIS-PB 234 476/AS $3.75**

A complete waste water treatment system has been installed as part of the new S. K. Williams Company job plating facility, to make the effluent suitable for discharge. Most of the metal finishing processes common to the industry are included in the plant. Five integrated waste treatment systems, each designed for a specific type of waste compound (cyanides, nickel, copper, chromates, and chromium), are used to protect the rinse waters from contamination by process solution drag-out. A batch-type treatment system handles miscellaneous and intermittent discharges. The system design aims for a minimum volume of sludge production and a unique and economical sludge dewatering technique is included. Improved rinsing efficiency is achieved through the use of the integrated chemical rinses, thus permitting the plant to operate on a minimum water supply. Chemical reaction efficiency was considered in the design of each phase of the treatment system. Data is presented on the operating and capital costs for the entire system and operating experiences are described. (Modified author abstract)

670/2-74-059 SIC 347 NON-FERROUS METALS GRANT NO. 12010 DOT

Laboratory Study of Continous Electro-oxidation of Dilute Cyanide Waste BY J. J. Byerley, and K. Enns, Waterloo, University of, Department of Chemical Engineering Waterloo, Ontario, Canada **ORDER FROM: NTIS-PB 235 588/AS $3.25**

Feasibility of detoxifying dilute cyanide plating wastes by electrooxidation was studied. Because of the toxicity of cyanide to aquatic and animal life and its detrimental effect on the the operation of sewage treatment plants, in-plant treatment of dilute cyanide waste is essential. An electrochemical demonstration unit was developed for the treatment of dilute cyanide plating wastes. The cyanide and plating metal concentrations can be reduced to less than 1 ppm. EPA CONTACT: Tabakin, R. B.

670/2-75-016 SIC 333 NON-FERROUS METALS GRANT NO. 801349

Reclamation of Sulfuric Acid From Waste Streams BY H. C. Peterson, and P. L. Kern, New Jersey Zinc Company Palmerton, PA **ORDER FROM: NTIS-PB 241 791/AS $4.25**

The New Jersey Zinc Company process for acid recovery employs evaporation to separate sulfuric acid from metallic sulfates. The salts are removed as dry, free-flowing solids and the acidladen off-gas is directly cooled to partially condense product acid having a concentration in excess of 85% H_2SO_4. The process was piloted at Palmerton, Pennsylvania, at a rate of two tons per day of sulfuric acid (100 percent basis) using as feed the waste stream of a titanium dioxide pigment plant. On the basis of the pilot work, a commercial plant was designed to process 345,000 metric tons annually of 19.5 percent H_2SO_4 waste and liquor from a 38,100 metricton-per-year pigment plant. The estimated investment (as of January 1, 1975) is $7,800,000. Operating costs (including depreciation at 10 percent) would be approximately $77 per metric ton of 100 percent H_2SO_4 recovered. This cost includes neutralization of the dried solids and disposal in a landfill site. EPA CONTACT: Skovronek, H. S.

REPORT ABSTRACTS SECTION

670/2-75-018 SIC 347 NON-FERROUS METALS GRANT NO. 12010 FXD

Reclamation of Metal Values from Metal-Finishing Waste Treatment Sludges BY A. B. Tripler Jr., R. H. Cherry Jr., and G. R. Smithson Jr., Battelle Columbus Laboratories Columbus, OH **ORDER FROM: NTIS-PB** 242 018/AS $4.75

The efforts of this program have included the determination of the worth of recovering metal values from metal-finishers' wastewater treatment sludges, the definition and research of processes for such recovery, and the selection, design, and costing of a recommended process. The study included a survey of the literature to determine the state-of-the-art regarding the generation, disposal, and recovery treatment practices relevant to metal-finishers' sludges, and to identify metal recovery processes possibly applicable to those sludges. This information was supplemented with a survey by questionnaire to determine the current status of relevant practices and conditions. Field investigations provided detailed examples of plant practices, sludge storage conditions, and sludge characteristics. The extraction of metal values from waste sludges by various leaching agents, and the recovery of metal values by techniques including electrowinning, cementation, and liquid-liquid ion exchange were studied. A portable pilot process for the treatment of waste sludges and recovery of metal values was selected and equipment and operating costs developed. EPA CONTACT: Harris, E. F.

670/2-75-029 SIC 335 NON-FERROUS METALS GRANT NO. 803226-01

Copper Recovery from Brass Mill Discharge by Cementation with Scrap Iron BY P. O. Case, Anaconda Company Waterbury, CT **ORDER FROM: NTIS-PB** 241 822/AS $4.25

This report presents the results of studies of copper recovery (and incidental reduction of hexavalent chromium) in brass mill discharge by passage of the discharge over scrap iron in a rotating drum. The drum feed consisted of normal production discharge of combined pickle rinse water and spent sulfuric acid and sulfuric acid-bichromate pickle. About half of the total mill waste discharge over a period of 16 weeks was processed. Four modes of drum operation were studied: (1) continuous rotation, (2) no rotation, (3) intermittent rotation (1 hr. off – 5 min. on), and (4) intermittent rotation (2–1/2 hr. off – 10 min. on). Each mode was studied at two flow levels and two scrap iron surface area levels. Data were evaluated in terms of percent cementation of available copper, excess iron consumption over theoretical, and completeness of chromium reduction. Results indicate that the overriding factor in the efficiency of copper cementation is the level of copper in the feed solution. Hexavalent chromium is effectively reduced providing the pH is below 2.5. EPA CONTACT: Tabakin, R. B.

670/2-75-055 SIC 347 NON-FERROUS METALS GRANT NO. 802113

Removal of Chromium from Plating Rinse Water Using Activated Carbon BY R. B. Landrigan, and J. B. Hallowell, Battelle Columbus Laboratories Columbus, OH **ORDER FROM: NTIS-PB** 243 370/AS $4.25

Chromium is a major pollutant in wastewaters from some electroplating operations. It can be effectively removed from rinse waters by adsorption on activated carbon, which must be regenerated when saturated with chromium to its upper limit. This study was concerned with the best means of regenerating the carbon under conditions which would return it as closely as possible to its original adsorptive capacity. The tests were conducted (1) on a laboratory scale to determine the effects of basic and acidic media on regeneration of chromium-loaded activated carbon, and (2) in a small pilot plant unit on the basis of the best results of the laboratory-scale work. In the latter case, tests were conducted on the unit operation for eight adsorption-desorption cycles. The overall results of this study suggest that a chromium removal unit could be installed in many of the small plating plants, relieving the burden on municipal sewage systems, and bringing the plating plant into compliance with local and Federal regulations. EPA CONTACT: Wilson, D.

R2-72-016 SIC 241 PULP, PAPER & WOOD IN-HOUSE PROJECT

Forest Fertilization—A State of the Art Review and Description of Environmental Effects BY W. A. Groman, National Environmental Research Center 200 SW 35th Street Corvallis, OR **ORDER FROM: NTIS-PB** 213 073 $5.25

600/2-76-090 SIC 242 PULP, PAPER & WOOD CONTRACT NO. 68-02-1485

Clean Fuels from Agricultural and Forestry Wastes BY J. W. Tatom, A. R. Colcord, J. A. Knight, and L. W. Elston, Georgia Institute of Technology Atlanta, GA **ORDER FROM: NTIS-PB** 259 956 EPA CONTACT: Kilgroe, J. D.

600/2-76-141 SIC 262 PULP, PAPER & WOOD CONTRACT NO. 68-02-2114

Particulate Collection Efficiency Measurements on an Electrostatic Precipitator Installed on a Paper Mill Recovery Boiler BY J. P. Gooch, and G. H. Marchant Jr., Southern Research Institute Birmingham, AL **ORDER FROM: NTIS-PB** 255 297 EPA CONTACT: Sparks, L. E.

REPORT ABSTRACTS SECTION

600/2-76-221 SIC 261 PULP, PAPER & WOOD GRANT NO. 803119

Removal of Soluble BODs in Primary Clarifiers BY G. A. Dubey, A. J. Wiley, and J. W. Collins, Institute of Paper Chemistry Appleton, WI **ORDER FROM: NTIS-PB** 259 919/as $6.75

This project was directed to evaluating means for increasing BOD removal from primary treatment systems treating pulp and paper wastes. An improved understanding of the optimal conditions for soluble and colloidal BOD removal should permit increasing efficiency in total organic removal. The initial phase surveyed 12 mills to obtain data on total and soluble BODs, COD, suspended solids and color removal from sedimentation systems. This data was used to select mill effluents for additional study. These laboratory studies showed that, with proper flocculating agents, soluble BOD removal could be markedly increased. Soluble BOD was defined as that organic load passing through a 0.45 micrometer filter. Gel chromatography studies showed that low molecular weight biodegradable residues and colloidal materials were flocculated and removed. Studies with model compounds indicated that increased removal is apparently related to pH of the solution and to functional groups, chain length, branching and solubility of the compound. Chemical costs may range from 3 cents to 10 cents per 1000 gallons. Cost reduction and improved clarifier performance can be achieved by elimination of overflows and spills within the mill that are antagonistic to efficient sedimentation due to dispersant action. EPA CONTACT: Scott, R. H.

600/2-76-231 SIC 249 PULP, PAPER & WOOD GRANT NO. 12110 HIG

Treating Wood Preserving Plant Wastewater by Chemical and Biological Methods BY J. T. White, T. A. Bursztynsky, J. D. Crane, and R. H. Jones, Koppers Company Carbondale, IL **ORDER FROM: NTIS-PB** 265 434 $5.50 EPA CONTACT: Phillips, J. H.

600/2-76-232 SIC 263 PULP, PAPER & WOOD GRANT NO. 801206

Water Reuse in a Paper Reprocessing Plant BY L. E. Streebin, G. W. Reid, P. Law, and C. Hagan, Big Chief Roofing Company Ardmore, OK **ORDER FROM: NTIS-PB** 265 232 $5.00 EPA CONTACT: Ruppersberger, J.

600/2-76-252 SIC 262 PULP, PAPER & WOOD GRANT NO. 12040 FED

Papermill Wastewater Treatment by Microstraining BY F. R. Bliss, Strathmore Paper Company Turner Falls, MA **ORDER FROM:** Pending EPA CONTACT: Conley, E.

600/2-76-262 SIC 241 PULP, PAPER & WOOD IN-HOUSE PROJECT

Effects of Log Handling and Storage of Water Quality BY G. S. Schuytema, and R. D. Shankland, Industrial Environmental Research Laboratory, EPA Corvallis, OR **ORDER FROM: NTIS-PB** 266 267 $5.00 EPA CONTACT: Willard, H. K.

600/3-76-111 SIC 261 PULP, PAPER & WOOD IAG NO. IAG-D5-F765

Design Considerations for Pulp and Paper-Mill Sludge Landfills BY R. H. Ledbetter, U.S. Army Engineer Waterways Experimentation Station Vicksburg, MS **ORDER FROM: NTIS-PB** 264 032 $6.75 EPA CONTACT: Landreth, R. E.

600/7-76-034e SIC 261 PULP, PAPER & WOOD CONTRACT NO. 68-03-2198

Environmental Considerations of Selected Energy Conserving Manufacturing Process Options. Vol. V. Pulp and Paper Industry Report Arthur D. Little, Inc. Cambridge, MA **ORDER FROM: NTIS-PB** 264 271 $7.75 EPA CONTACT: Skovronek, H. S.

650/2-74-005 SIC 261 PULP, PAPER & WOOD GRANT NO. AP-01269-0

Indigester Black Liquor Oxidation for Odor Control in Kraft Pulping BY W. T. McKean, and J. S. Gratzl, North Carolina State University, Department of Wood and Paper Sciences Raleigh, NC **ORDER FROM: NTIS-PB** 228 692 $5.25 EPA CONTACT: Hendrika, R. V.

REPORT ABSTRACTS SECTION

650/2-74-071a SIC 261 PULP, PAPER & WOOD CONTRACT NO. 68-02-0247

Improved Air Pollution Control for Kraft Recovery Boiler: Modified Recovery Boiler No. 3 Hoerner Waldorf Corporation St. Paul, MN **ORDER FROM: NTIS-PB** 237 627/AS $7.00

The report gives results of an intensive emission testing program to verify the anticipated reduction in both gaseous and particulate air pollutants caused by the conversion of a conventional kraft recovery boiler (utilizing direct contact evaporation) to a new controlled-odor design that eliminates direct contact evaporation. It documents both the cost and emission control capability of the modification. The program also investigated major process variables that affect kraft recovery boiler operation and the emissions resulting therefrom in order to establish boiler operating conditions to minimize emissions. Investigated were: boiler loading, liquor sulfidity, air flow, air distribution, and liquor solids concentration. Particulate emissions were primarily affected by and directly proportional to the amount of black liquor solids burned in the recovery furnace (boiler loading). SO_2 emissions were primarily dependent on the sulfidity level of the cooking liquor being recovered. Total reduced sulfur (TRS) emissions were primarily affected by excess oxygen levels, with an increase in oxygen resulting in a decrease in TRS. EPA CONTACT: Gottlieb, M.

650/2-74-071b SIC 261 PULP, PAPER & WOOD CONTRACT NO. 68-02-0247

Improved Air Pollution Control for a Kraft Recovery Boiler: Recovery Boiler No. 4 Hoerner Waldorf Corporation St. Paul, MN **ORDER FROM: NTIS-PB** 240 442/AS $4.75

The report gives results of intensive tests to establish the level of both gaseous and particulate air pollutants discharged from a controlled-odor kraft recovery boiler. It documents both the cost and emission control capability of such a boiler, designed and erected without direct contact evaporation of the feed liquor. Also investigated were major process variables that affect kraft recovery boiler operation and the emissions resulting therefrom in order to establish boiler operating conditions that minimize emissions. Investigated were boiler loading, liquor sulfidity, and liquor distribution within the furnace. Test data was analyzed statistically by computer, using the multiple regression analysis technique. Particulate emissions were primarily affected by and directly proportional to the amount of black liquor solids burned in the recovery furnace (boiler loading). Both SO_2 and total reduced sulfur (TRS) emissions were affected by liquor sulfidity; emissions increased as sulfidity levels increased. This new kraft recovery boiler incorporates the most recent technology for air pollution control, enabling it to meet the Montana state emission standards for both TRS and particulates. EPA CONTACT: Denny, D. A.

660/2-73-010 SIC 261 PULP, PAPER & WOOD GRANT NO. 12130 DBF

Treatment of Domestic Wastewater and NSSC Pulp and Paper Mill Wastes BY P. J. Farrell, L. R. Hable, and A. G. Stenhser, Harriman Utility Board Harriman, TN **ORDER FROM: NTIS-PB** 231 267/AS

The Harriman Utility Board and the Mead Corporation made a study of the joint treatment of primary clarified domestic waste and neutral sulfite semichemical (NSSC) pulp and paper mill wastes. The most effective treatment scheme consisted of a biofilter (used as a roughing filter) and an extended aeration system. Color reduction was accomplished by massive lime and chlorine additions due to the color's dependency on pH. Disinfection was optimum when ammonia was mixed with the combined wastes prior to chlorination. The biofilter's BOD removal efficiency ranged from 3 to 45%. Extended aeration's BOD removal efficiency ranged from 24 to 98%. (Modified author abstract) EPA CONTACT: Lomasney, E. P.

660/2-73-019 SIC 261 PULP, PAPER & WOOD GRANT NO. 800261

Color Removal From Kraft Mill Effluents By Ultrafiltration BY H. A. Fremount, D. C. Tate, and R. L. Goldsmith, U.S. Plywood-Champion Paper, Inc. Hamilton, OH **ORDER FROM: NTIS-PB** 231 257/AS

The purpose of the research described was to examine ultrafiltration as a means of reducing color in kraft mill effluents more efficiently and/or more economically than the presently available method. The program included the six month operation of a 10,000 gpd pilot plant at the Champion Papers' Canton, North Carolina, pulp and paper mill. The major experimental effort dealt with treatment of pine bleaching caustic extraction filtrate with lesser emphasis on unbleached pine and hardwood pulp washing Decker effluents. Four experimental aspects of the process were evaluated: feed pretreatment, ultrafiltration, concentrate disposal and water reuse potential. The total operating costs, including amortization and exclusive of credits for a one million gallon per day treatment plant are estimated. EPA CONTACT: Lomasney, E. P.

660/2-73-028 SIC 261 PULP, PAPER & WOOD GRANT NO. 12040 GQD

Coliform Bacteria Growth and Control in Aerated Stabilization Basins BY S. W. Watkins, Crown Zellerbach Corporation Camas, WA **ORDER FROM: NTIS-PB** 231 259/AS

Secondary effluent from an ammonia base sulfite mill in Lebanon, Oregon, increased concentrations of coliforms (total coliform bacteria) in receiving waters to more than 1000 per 100 ml, the State standard. Factors responsible for high coliform populations were determined and a disinfection method was developed for reducing their numbers in secondary effluent. Chlorination was often ineffective. However, by injecting NaOH into the chlorinator's water supply, adequate coliform kill was achieved with approximately 5.7 ppm chlorine and 3.3 ppm NaOH. Continuous chlorination effected a reduction in coliforms in receiving waters to acceptable levels and the chlorinated effluent had a low degree of toxicity to salmonid fingerlings. EPA CONTACT: Knittel, M. D.

REPORT ABSTRACTS SECTION

660/2-73-030 SIC 261 PULP, PAPER & WOOD GRANT NO. 801207

Treatment of Sulfite Evaporator Condensates for Recovery of Volatile Components BY K. W. Baierl, N. L. Chang, B. F. Lueck, A. J. Wiley, and R. A. Holm, Institute of Paper Chemistry Appleton, WI **ORDER FROM: NTIS-PB** 233 139

A pilot plant study of a process to recover the volatile constituents of the condensate derived from the evaporation of a sulfite spent wood pulping liquor has been made. The data from this one-year evaluation confirm prior work demonstrating that recovery of sulfur dioxide, furfural, methanol, and acetic acid (in the form of ethyl acetate) will yield reusable and salable materials, and provide 60 to 90% BOD reduction. The work reported covers four major sections: (1) Assay of condensate samples from supporting mills; (2) Operation and data of a pilot system comprising steam stripping, activated carbon adsorption, and fractional distillation; (3) Mass heat, and BOD balances made according to the actual operating condition of the pilot plant at the Appleton Division mill of Consolidated Papers, Inc. to January 1973; and (4) Low temperature (200C) regeneration of carbon. Mass and heat balances, recoverable product values, and credits for BOD removal combine to show the process to be a favorable avenue for the elimination of the pollution potential of the sulfite condensate waste. (Modified author abstract) EPA CONTACT: Scott, R. H.

660/2-74-008 SIC 261 PULP, PAPER & WOOD GRANT NO. 12040 DRY

Color Removal and Sludge Disposal Process for Kraft Mill Effluents BY E. L. Spruill, Continental Can Company Hodge, LA **ORDER FROM: NTIS-PB** 235 573/AS

A treatment plant, removing color by lime addition and recovering sludges, has been treating over 80% of the effluent of an unbleached kraft mill for one year. Using up to 1,100 mg/1 of CaO, with normal mill fiber loss as a precipitation aid, average color reduction was 80% for all-kraft effluent. The chief negative factor is need for emergency protection against alkaline impact on secondary treatment and receiving stream. Following centrifuge dewatering, sludge incineration has had minimal impact on kiln operation; there were some adverse effects on lime quality. Lime recovery was 93%. Mill kiln capacity must be increased about 25%. Primary clarification and sludge disposal are included in the process. Costs are estimated. (Modified author abstract) EPA CONTACT: Hill, R. L.

660/2-74-029 SIC 261 PULP, PAPER & WOOD GRANT NO. 800853

Color Characterization Before and After Lime Treatment BY H. S. Dugal, R. M. Leekley, and J. W. Swanson, Institute of Paper Chemistry Appleton, WI **ORDER FROM: NTIS-PB** 235 493/AS

Approximately 90 percent of the United States' chemical wood pulp is produced by the kraft pulping process. In spite of various measures taken to reduce pollution, kraft mill effluents discharged into streams are objectionable in color, and further improvements are needed to reduce the color of these effluents. The nature of color bodies in kraft mill effluents apparently has not been fully investigated. Presumably, two wastes are believed to be the main sources of color in the effluents: weak black liquor and effluent from the caustic extraction stages in the bleach plant. In addition, some color may form in the holding ponds. The present project has been divided into two parts. The first part has been concerned with the chemical and the physical characterization of the color bodies in the mill effluents both before and after lime treatment. Effluents from two different mills were studied. Part of this report deals with the study of effluent from the International Paper Company (IPCO) mill at Springhill, Louisiana, and the Continental Can Company (CONCO) mill at Hodge, Louisiana. The second part of the project has been concerned with the lime treatment of mill effluents in the presence of multivalent ions. The objective was to establish conditions for an improved lime-treatment process using small amounts of multivalent ions of other metals in addition to lime. EPA CONTACT: Scott, R. H.

660/2-74-044 SIC 261 PULP, PAPER & WOOD GRANT NO. 801876

Test Method for Volatile Component Stripping of Wastewater BY L. J. Thibodeaux, Arkansas, University of, College of Engineering Fayetteville, AR **ORDER FROM: NTIS-PB** 235 567/AS

This work is concerned with the air-strippable volatile organic fraction of industrial wastewaters. The primary purpose was to develop laboratory apparatus and procedures that may be employed to assess the desirability of air-stripping in cooling towers as a treatment operation for removal of a portion of the organics from industrial wastewater. The apparatus developed consists of a short packed (Intalox Saddle) section with liquid recirculation and single pass countercurrent air flow. Desorption is performed in the apparatus at 25C and ambient pressure conditions. Samples were representative of: poultry, metal, oil-field, canning, pharmaceutical, paper, food, fibers, petroleum refinery and petrochemical industries. BOD, COD, TOC and gas chromatographic analysis were employed with the experiments. Industrial wastewaters were found to contain a nonvolatile organic fraction that remains in the aqueous phase and a volatile organic fraction that can be transferred to the air phase. The net result of the desorption experiments is that some industrial wastewaters can be effectively treated by air-stripping a sizeable portion of the dissolved organics. (Modified author abstract)

REPORT ABSTRACTS SECTION

660/2-74-069 SIC 261 PULP, PAPER & WOOD GRANT NO. 12040 DEH

Studies of Low Molecular Weight Lignin Sulfonates BY W. G. Glasser, J. S. Gratzl, K. Forso, B. F. Hrutfiord, L. N. Johanson, J. L. McCarthy, and J. Collins, Washington, University of Seattle, WA **ORDER FROM: NTIS-PB** 239 368/AS

Low molecular weight lignin sulfonates have been separated in purified form and characterized by physicochemical and chemical methods. Their structure and reactions have been evaluated. Lignin sulfonates from the spent sulfite liquor of a mild acid bisulfite cook of Western Hemlock (Tsuga heterophylla) were purified and fractionated in Sephadex G-25 column chromatography. Complete elemental and functional group compositions were established for lignin sulfonates from a spent sulfite liquor and compared to those from milled wood lignin preparation. Extended separation studies indicated the low molecular weight lignin sulfonates to be the reaction product of a difunctional vinyl-type polymerization. The feasibility of large scale separations was determined using (1) the extraction and precipitation of the dry matter in a spent sulfite liquor with alcohol, and (2) the fractionation of the material by ion exclusion in a column arrangement. EPA CONTACT: Willard, K.

660/2-74-086 SIC 261 PULP, PAPER & WOOD GRANT NO. 12040 HDU

Mercury Recovery from Contaminated Waste Waters and Sludges Georgia Pacific Corporation Bellingham, WA **ORDER FROM: NTIS-PB** 238 600/AS

A plant was deisgned, built and operated to remove Hg from wastewater and sludge produced by a mercury cell chlor-alkali plant. Mercury content of the wastewater reanged from 300–18,000 ppb mercury while mercury content of the brine sludge ranged from 150 to 1500 ppm Hg. Other sludges processed included sludges from the waterway near our plant outfall with a Hg content of 10–25 ppm Hg. From a variety of removal techniques tried in the lab, the methods selected were sulfide precipitation for the water treatment and high temperature roasting for the sludge treatment. The sulfide precipitation consists of collecting the various water streams, adjusting the pH from 5–8 with spent sulfuric acid, settling the large solid particles in a surge tank, adding sodium sulfide to a 1–3 ppm excess, adding diatomaceous earth at the rate of 0.07 gpl in an R.P. Adams pressure filter. The effluent Hg levels range from 10–125 ppb with an average of 50 ppb Hg for an 87–99% removal, averaging 96.8%. The sludge system contains a collection system, 3.7 m diameter thickener, 1.8 m diameter rotary vacuum filter. 1.37 m i.d. multiple hearth furnace, and 3 stainless steal condensers 21 sq m each. Processing rate for the sludge is 140–320 kg/hr, dry basis. Capital costs were $364,500 and operating costs were $32 per m ton of dry sludge treated EPA CONTACT: Jaworski Dr., N. A.

660/2-75-004 SIC 261 PULP, PAPER & WOOD GRANT NO. 12040 EJU

Activated Carbon Treatment of Unbleached Kraft Effluent for Reuse BY E. W. Lang, W. G. Timpe, and R. L. Miller, St. Regis Paper Company Pensacola, FL **ORDER FROM: NTIS-PB** 243 246/AS $7.25

A four-year pilot plant program was carried out to investigate the technical and economic feasibility of treating unbleached kraft pulp and paper mill effluent for reuse. Preliminary laboratory studies and cost estimates indicated that the following treatment sequences should be investigated in the pilot plant; (1) Primary clarification, carbon adsorption; (2) lime treatment, carbon adsorption; (3) primary clarification, bio-oxidation, carbon adsorption. Water of reusable quality can be provided from unbleached kraft effluent by several combinations of treatment utilizing activated carbon. Unbleached pulping effluents typically contain about 1000 color units, 250 mg/1 TOC, and 250 mg/1 BOD. Reusable water quality as defined in this study is 100 color units and 100 mg/1 TOC. The most economical treatment is the microlime-carbon process that utilizes low dosages of lime and clarification followed by carbon adsorption in down-flow granular carbon beds. Capital cost for treatment by the process of 9.6 mgd of unbleached kraft effluent from an 800-ton-per-day mill was estimated to be approximately $6.7 millions. Operating costs, inclusive of capital depreciation, were estimated to be $0.30 per 1000 gal and $3.58 per pulp-ton, including credit for the reused water. EPA CONTACT: Ruppersberger, J.

660/2-75-024 SIC 263 PULP, PAPER & WOOD IN-HOUSE PROJECT

Taxonomy of Klebsiella pneumoniae Isolated From Pulp/Paper Mill Wastewater BY M. D. Knittel, Pacific Northwest Environmental Research Laboratory, EPA Corvallis, OR **ORDER FROM: NTIS-PB** 244 405/AS $3.75 Klebsiella pneumoniae isolated from pulp mills was compared to clinical isolates of K. pneumoniae. Cultures found to be identical in biochemical reaction in various media and conformed to the recognized schemes of classification of K. pneumoniae. Nucleic acid base composition comparison of these isolates showed that all exhibited a G + C% base composition of 56% + or – 1.4%, and all cultures examined fell within this range. A study of the heterologous binding capability between DNAs of these cultures revealed that isolates from both the environment and pathogenic reference had a base sequence from 80 to 100% in common. This confirms the earlier results that pulp mill isolates are the same as clinical isolates. EPA CONTACT: Knittel, M. D.

REPORT ABSTRACTS SECTION

660/2-75-028 SIC 261 PULP, PAPER & WOOD GRANT NO. 800814

Organic Compounds in Pulp Mill Lagoon Discharge BY B. F. Hrutfiord, T. S. Friberg, D. F. Wilson, and J. R. Wilson, Washington, University of Seattle, WA **ORDER FROM: NTIS-PB** 246 900/AS $4.50

Organic compounds entering and leaving kraft mills aerated lagoons have been identified and determined quantitatively. The compounds found were terpenes and related low B.P. materials, resin and fatty acids, phenols and sugar acids. The terpenes, resin and fatty acids are similar to those present in the wood species being pulped. Some turpenes, phenols and sugar acids are produced during the pulping reactions. About 8 ppm total terpenes were found in the lagoon influent and 1 ppm or less were in the effluent. Alpha-Terpineol was the major compound entering the lagoon and camphor the main terpene in the effluent. The total resin acid concentration entering the lagoon was 3.2 ppm with 0.6 ppm leaving. Fatty acids were lower both entering and leaving the lagoon. Sugar acids were found at about 100 ppm total entering, these were usually completely eliminated in the lagoon. Control of terpenes can be done by in-process steam stripping and the other compounds can be partially controlled by in-plant spill containment. EPA CONTACT: Keith, L.

660/4-75-005 SIC 261 PULP, PAPER & WOOD IN-HOUSE PROJECT

Analysis of Organic Compounds in Two Kraft Mill Wastewaters BY L. W. Keith, Southeast Environmental Research Laboratory Athens, GA **ORDER FROM: NTIS-PB** 247 698 $5.50

670/2-73-085 SIC 242 PULP, PAPER & WOOD GRANT NO. EP-00276-0

Utilization of Bark Wastes BY R. A. Currier, and M. L. Lauer, Oregon State University Corvallis, OR **ORDER FROM: NTIS-PB** 221 876 $7.00

R2-73-108 SIC 721 WATER & SEWAGE GRANT NO. 12120 DOD

Treatment of Laundromat Wastes BY D.B. Aulenbach, M. Chilson, and P.C. Town, Rensselaer Polytechnic Institute Troy, NY **ORDER FROM: NTIS-PB** 227 369 EPA CONTACT: R. Keppler

660/2-73-037 SIC 721 WATER & SEWAGE GRANT NO. 12120 FYV

Modular Wastewater Treatment System Demonstration for the Textile Maintenance Industry BY G. Douglas, Envirex, Inc. Milwaukee, WI **ORDER FROM: NTIS-PB** 231 837

660/2-74-007 SIC 494 WATER & SEWAGE GRANT NO. 12120 GLE

Industrial Water Softener Waste Brine Reclamation BY J. Burton, and E. Kreusch, Culligan International Company Northbrook, IL **ORDER FROM: NTIS-PB** 233 132

Discharge of brine wastes from water softener regeneration to sewers or receiving streams is often undesirable because of possible pollution. Brine reclamation and reuse has been studied for one year at a central regeneration plant for portable ion exchange water softeners. The process is modified lime-soda softening and is operated in daily batches. This process produces a 95% sodium chloride brine, which is perfectly acceptable for reuse as a regenerant brine. This process is feasible technically, but is marginal economically. Performance data and cost estimate are included. (Modified author abstract)

660/2-74-085 SIC 495 WATER & SEWAGE GRANT NO. 12120 HRA

Physical-Chemical Treatment of Municipal Wastes by Recycled Magnesium Carbonate BY A. P. Black, A. T. DeBoso, and R. P. Vogh, Gainesville, City of Gainesville, FL **ORDER FROM: NTIS-PB** 239 326/AS

The applicability to municipal wastes of the recently discovered magnesium carbonate-lime water treatment process has been investigated. A sixteen-month laboratory study was conducted and was followed by an eight-month pilot plant study. Four wastewaters with CO values varying from 200 to 1,500 mg/1 were examined. Bench-scale coagulation studies designed to compare the effect of added $MgCO_3$ with treatment by lime only showed a 0%-30% greater reduction in effluent COD residuals. Color and turbidity reduction by the magnesium-plus-lime process averaged 50%-85% greater when compared to treatment by lime only. A series of 72-hour pilot plant runs was conducted with the magnesium precipitated increased after each three day period. Effluent characteristics improved as the amount of magnesium precipitated was increased. Influent and filter effluent samples were collected every four hours and analysed for COD, TOC, total phosphorus, alkalinity, hardness, calcium, and magnesium. Values for BOD were determined from composited samples.

REPORT ABSTRACTS SECTION

660/2-75-006 **SIC 494 WATER & SEWAGE** **GRANT NO. 12120 HMZ**

Plant Scale Studies of the Magnesium Carbonate Water Treatment Process BY A. P. Black, and C. G. Thompson, Black, Crow and Eidsness, Inc. Montgomery, AL ORDER FROM: NTIS-PB 242 253/AS $6.25 EPA CONTACT: Boydston, J.

SIC INDEX

SIC 001 ALL INDUSTRY

Energy Consumption: Fuel Utilization and Conservation in Industry – REF. NO. EPA-650/2-75-032d
Environmental Consideration of Selected Energy Conserving Manufacturing Process Options. Vol. I. Industry Summary Report – REF. NO. EPA-600/7-76-034a
Environmental Considerations of Selected Energy Conserving Manufacturing Process Options. Vol. II. Industry Priority Report – REF. NO. EPA-600/7-76-034b
Projects in the Industrial Pollution Control Division – December 1974 – REF. NO. EPA-600/2-75-001
Survey of Emissions and Controls for "Hazardous" and Other Pollutants, A – REF. NO. EPA-R4-73-021

SIC 280 CHEMICALS, GENERAL

Energy Consumption: The Chemical Industry – REF. NO. EPA-650/2-75-032a

SIC 281 INORGANIC CHEMICALS

Construction of a Prototype Sulfuric Acid Mist Monitor – REF. NO. EPA-600/2-76-211
Dialysis for Concentration and Removal of Industrial Wastes – REF. NO. EPA-600/2-76-223
Effect of Equipment Maintenance and Age on Sulfuric Acid Plant Emissions – REF. NO. EPA-600/2-76-119
Environmental Considerations of Selected Energy Conserving Manufacturing Process Options. Vol. XII. Chlor-Alkali Industry Report – REF. NO. EPA-600/7-76-034l
Environmental Considerations of Selected Energy Conserving Manufacturing Process Options. Vol. XIII. Phosphorus/ Phosphoric Acid Industry Report – REF. NO. EPA-600/7-76-034m
Fluoride Emissions from Phosphoric Acid Plant Gypsum Ponds – REF. NO. EPA-650/2-74-095
Industrial Process Profiles for Environmental Use: Chapter 15. Brine and Evaporite Chemicals Industry – REF. NO. EPA-600/2-77-023o
Industrial Process Profiles for Environmental Use: Chapter 23. Sulfur, Sulfur Oxides and Sulfuric Acid – REF. NO. EPA-600/2-77-023w
Inorganic Chemicals Industry Profile – REF. NO. EPA-12020EJI07/71
Molecular Sieve Control Process in Sulfuric Acid Plants – REF. NO. EPA-600/2-75-066
Molecular Sieve Mercury Control Process in Chlor-Alkali Plants – REF. NO. EPA-600/2-76-014
Molecular Sieve Tests for Control of Sulfuric Acid Plant Emissions – REF. NO. EPA-600/2-76-047
Neutralization of Abatement Derived Sulfuric Acid – REF. NO. EPA-R2-73-187
Pyrite Depression by Reduction of Solution Oxidation Potential – REF. NO. EPA-12010DIM08/70
Renovation of Industrial Inorganic Wastewater by Evaporation with Interface Enhancement – REF. NO. EPA-600/2-76-017
State-of-The-Art For The Inorganic Chemicals Industry: Industrial Inorganic Gases – REF. NO. EPA-600/2-74-009c
Sulfuric Acid Plant Emissions During Start-up, Shutdown, and Malfunction – REF. NO. EPA-600/2-76-010

SIC 282 SYNTHETIC MATERIALS

Air Flotation – Biological Oxidation of Synthetic Rubber and Latex Wastewater – REF. NO. EPA-660/2-73-018
Characterization of Atmospheric Emissions from Polyurethane Resin Manufacture – REF. NO. EPA-650/2-74-107
Industrial Process Profiles for Environmental Use: Chapter 10. Plastics and Resins Industry – REF. NO. EPA-600/2-77-023j
Industrial Process Profiles for Environmental Use: Chapter 16. The Fluorocarbon-Hydrogen Fluoride Industry – REF. NO. EPA-600/2-77-023p
Industrial Process Profiles for Environmental Use: Chapter 9. The Synthetic Rubber Industry – REF. NO. EPA-600/2-77-023i
Scientific and Technical Assessment Report on Vinyl Chloride and Polyvinyl Chloride – REF. NO. EPA-600/6-75-004
System Analysis of Air Pollutant Emissions from the Chemical/ Plastics Industry – REF. NO. EPA-650/2-74-106
Vinyl Chloride – An Assessment of Emissions Control Techniques and Costs – REF. NO. EPA-650/2-74-097
Wastewater Treatment Facilities for a Polyvinyl Chloride Production Plant – REF. NO. EPA-12020DJI06/71

SIC 283 DRUGS

Characterization of Waste Waters from the Ethical Pharmaceutical Industry – REF. NO. EPA-670/2-74-057

SIC INDEX

SIC 284 SOAPS & DETERGENTS

Testing of a Molecular Sieve Used to Control Mercury Emission From A Chlor-Alkali Plant, Volume I – REF. NO. EPA-650/2-75-026a
Testing of a Molecular Sieve Used to Control Mercury Emission From A Chlor-Alkali Plant, Volume II – Appendices – REF. NO. EPA-650/2-75-026b

SIC 285 PAINTS

Ion Exchange Process for Recovery of Chromate from Pigment Manufacturing – REF. NO. EPA-670/2-74-044
Waterborne Wastes of the Paint and Inorganic Pigments Industries – REF. NO. EPA-670/2-74-030

SIC 286 INDUSTRIAL ORGANIC CHEMICALS

Anaerobic Treatment of Synthetic Organic Wastes – REF. NO. EPA-12020DIS01/72
Biological Treatment of Chlorophenolic Wastes – REF. NO. EPA-12130EGK06/71
Converting Chlorohydrocarbon Wastes by Chlorolysis – REF. NO. EPA-600/2-76-270
Effect of Chlorination on Selected Organic Chemicals – REF. NO. EPA-12020EXG03/72
Environmental Catalog of Industrial Processes; Volume II— Industrial Organic Chemicals – REF. NO. EPA-600/2-76-051b
Environmental Considerations of Selected Energy Conserving Manufacturing Process Options. Vol. VI. Olefins Industry Report – REF. NO. EPA-600/7-76-034f
Evaluation and Upgrading of a Multi-Stage Trickling Filter Facility – REF. NO. EPA-600/2-76-195
Fluidized-Bed Incineration of Selected Carbonaceous Industrial Wastes – REF. NO. EPA-12120FYF03/72
Hydrocarbon Emissions Reduction From Ethylene Dichloride Processes – REF. NO. EPA-600/2-76-053
Identification and Control of Petrochemical Pollutants Inhibitory to Anaerobic Processes – REF. NO. EPA-R2-73-194
Industrial Process Profiles for Environmental Use: Chapter 13. Plasticizers Industry – REF. NO. EPA-600/2-77-023m
Industrial Process Profiles for Environmental Use: Chapter 6. The Industrial Organic Chemicals Industry – REF. NO. EPA-600/2-77-023f
Industrial Process Profiles for Environmental Use: Chapter 7. Organic Dyes and Pigments Industry – REF. NO. EPA-600/2-77-023g
Odor Removal from Air by Adsorption on Charcoal – REF. NO. EPA-650/2-74-084
Optimizing a Petrochemical Waste Bio-Oxidation System Through Automation – REF. NO. EPA-660/2-75-021
Petrochemical Effluents Treatment Practices – Summary – REF. NO. EPA-12020—02/70
Polymeric Materials for Treatment and Recovery of Petrochemical Waste – REF. NO. EPA-12020DQC03/71
Projected Wastewater Treatment Costs in the Organic Chemicals Industry – REF. NO. EPA-12020GND07/71
Radiation Treatment of High Strength Chlorinated Hydrocarbon Wastes – REF. NO. EPA-660/2-75-017
Recondition and Reuse of Organically Contaminated Waste Sodium Chloride Brines – REF. NO. EPA-R2-73-200
Scientific and Technical Assessment Report on Particulate Polycyclic Organic Matter (PPOM) – REF. NO. EPA-600/6-75-001
Solvent Extraction Status Report – REF. NO. EPA-R2-72-073
Source Assessment: Phthalic Anhydride – REF. NO. EPA-600/2-76-032d
Technical Manual for Process Sampling Strategies for Organic Materials – REF. NO. EPA-600/2-76-122
Treatment and Disposal of Complex Industrial Wastes – REF. NO. EPA-600/2-76-123
Treatment of Wastewater from the Production of Polyhydric Organics – REF. NO. EPA-12020EEQ10/71
Vapor-Phase Organic Pollutants – Volatile Hydrocarbons and Oxidation Products – REF. NO. EPA-600/1-75-005

SIC 289 MISC. CHEMICALS

Industrial Process Profiles for Environmental Use: Chapter 12. The Explosives Industry – REF. NO. EPA-600/2-77-023l
Naval Stores Wastewater Purification and Reuse by Activated Carbon Treatment – REF. NO. EPA-600/2-76-227
Pilot Plant Optimization of Phosphoric Acid Recovery Process – REF. NO. EPA-670/2-75-015
State of-the-Art: Military Explosives and Propellants Production Industry. Volume III – Wastewater Treatment – REF. NO. EPA-600/2-76-213c
State-of-the-Art: Military Explosives and Propellants Production Industry. Volume I – The Military Explosives and Propellants Industry – REF. NO. EPA-600/2-76-213a
State-of-the-Art: Military Explosives and Propellants Production Industry. Volume II – Wastewater Characterization – REF. NO. EPA-600/2-76-213b
State-of-The-Art For The Inorganic Chemicals Industry: Commercial Explosives – REF. NO. EPA-600/2-74-009b

SIC 200 FOOD, GENERAL

Energy Consumption: Paper, Stone/Clay/Glass/Concrete, and Food Industries – REF. NO. EPA-650/2-75-032c
IERL-RTP Procedures Manual: Level 1 Environmental Assessment – REF. NO. EPA-600/2-76-160a
Proceedings of the Sixth National Symposium on Food Processing Wastes – REF. NO. EPA-600/2-76-224
Proceedings First National Symposium on Food Processing Wastes – REF. NO. EPA-12060—04/70
Proceedings Fourth National Symposium on Food Processing Wastes – REF. NO. EPA-660/2-73-031
Proceedings Second National Symposium on Food Processing Wastes – REF. NO. EPA-12060—03/71
Proceedings Seventh National Symposium on Food Processing Wastes – REF. NO. EPA-600/2-76-304

SIC INDEX

SIC 200 FOOD, GENERAL

Proceedings: Third National Symposium on Food Processing Wastes – REF. NO. EPA-R2-72-018
Proceedings: Fifth National Symposium on Food Processing Wastes – REF. NO. EPA-660/2-74-058
Scientific and Technical Assessment Report on Cadmium – REF. NO. EPA-600/6-75-003
Wastewater Use in the Production of Food and Fiber—Proceedings of a Conference Held at Oklahoma City, OK, March 5-7,1974 – REF. NO. EPA-660/2-74-041

SIC 201 MEAT

Egg Breaking and Processing Waste Control and Treatment – REF. NO. EPA-660/2-75-019
Elimination of Water Pollution by Packing-house Animal Paunch and Blood – REF. NO. EPA-12060FDS11/71
Evaluation of Polymeric Clarification of Meat-Packing and Domestic Wastewaters – REF. NO. EPA-660/2-74-020
National Meat-Packing Waste Management Research and Development Program – REF. NO. EPA-R2-73-178
Paunch Manure as a Feed Supplement in Channel Catfish Farming – REF. NO. EPA-660/2-74-046
Poultry Processing Wastewater Treatment and Reuse – REF. NO. EPA-660/2-74-060
Treatment of High Strength Meatpacking Plant Wastewater by Land Application – REF. NO. EPA-600/2-76-302
Treatment of Packing House Waste by Anaerobic Lagoons in Plastic-Media Filters – REF. NO. EPA-660/2-74-027
Water and Waste Management in Poultry Processing – REF. NO. EPA-660/2-74-031
Workshop on In-Plant Waste Reduction in the Meat Industry – REF. NO. EPA-600/2-76-214

SIC 202 DAIRY

Dairy Food Plant Wastes and Waste Treatment Practices – REF. NO. EPA-12060EGU03/71
Elimination of pollution from Cottage Cheese Whey by Drying and Utilization – REF. NO. EPA-600/2-76-254
Improvement of Treatment of Food Industry Waste – REF. NO. EPA-660/2-74-035
Membrane Processing of Cottage Cheese Whey for Pollution Abatement – REF. NO. EPA-12060DXF07/71
Protein Production from Acid Whey VIA Fermentation – REF. NO. EPA-660/2-74-025
Treatment of Cheese Processing Wastewaters in Aerated Lagoons – REF. NO. EPA-660/2-74-012
Whey Effluent Packed Tower Trickling Filtration – REF. NO. EPA-12130DUJ09/71

SIC 203 FRUIT & VEGETABLE

Aerated Lagoon Treatment of Food Processing Wastes – REF. NO. EPA-12060---03/68*
Aerobic Secondary Treatment of Potato Processing Wastes – REF. NO. EPA-12060EHV12/70
Aerobic Treatment of Fruit Processing Wastes – REF. NO. EPA-12060FAD10/69
Anaerobic and Aerobic Treatment of Combined Potato Processing/Municipal Wastes – REF. NO. EPA-600/2-76-236
Cannery Waste Biological Sludge Disposal as Cattle Feed – REF. NO. EPA-600/2-76-253
Cannery Waste Treatment by Anaerobic Lagoons and Oxidation Ditch – REF. NO. EPA-R2-73-017
Cannery Waste Treatment Kehr Activated Sludge – REF. NO. EPA-12060EZP09/70
Cannery Wastewater Treatment with Rotating Biological Contactor and Extended Aeration – REF. NO. EPA-R2-73-024
Combined Treatment of Domestic and Industrial Wastes by Activated Sludge – REF. NO. EPA-12130EZR05/71
Complete Mix Activated Sludge Treatment of Citrus Process Wastes – REF. NO. EPA-12060EZY08/71
Continuous Inplant Hot Gas Blanching of Vegetables – REF. NO. EPA-660/2-74-091
Current Practice in Potato Processing Waste Treatment – REF. NO. EPA-12060---10/69
Demonstration of a Full-Scale Waste Treatment System for a Cannery – REF. NO. EPA-12060DSB09/71
Dry Caustic Peeling of Clingstone Peaches on a Commercial Scale – REF. NO. EPA-660/2-74-092
Dry Caustic Peeling of Tree Fruit for Liquid Waste Reduction – REF. NO. EPA-12060FQE12/70
Infrared Dry Caustic vs. Wet Caustic Peeling of White Potatoes – REF. NO. EPA-660/2-74-088
Liquid Wastes from Canning and Freezing Fruits and Vegetables – REF. NO. EPA-12060EDK08/71
Low Water Volume Enzyme Deactivation of Vegetables Before Preservation – REF. NO. EPA-R2-73-198
Pilot Plant Installation for Fungal Treatment of Vegetable Canning Wastes – REF. NO. EPA-12060EDZ08/71
Potato Waste Treatment (Proceedings of a Symposium) – REF. NO. EPA-12060---03/68
Reconditioning of Food Processing Brines – REF. NO. EPA-12060EHU03/71
Reduction of Salt Content of Food Processing Liquid Waste Effluent – REF. NO. EPA-12060DXL01/71
Secondary Treatment of Potato Processing Wastes – REF. NO. EPA-12060---07/69
Treatment of Citrus Processing Wastes – REF. NO. EPA-12060---10/70
Trickling Filter Treatment of Fruit Processing Waste Waters – REF. NO. EPA-12060EAE09/71
Use of Fungi Imperfecti in Waste Control – REF. NO. EPA-12060EHT07/70
Waste Citrus Activated Sludge As a Poultry Feed Ingredient – REF. NO. EPA-660/2-75-001
Waste Control and Abatement in the Processing of Sweet Potatoes – REF. NO. EPA-660/2-73-021
Waste Reduction in Food Canning Operations – REF. NO. EPA-12060—08/70
Wastewater Abatement in Canning Vegetables by IQB Blanching – REF. NO. EPA-660/2-74-006
Wastewater Characterization for the Specialty Food Industry – REF. NO. EPA-660/2-74-075

SIC INDEX

SIC 204 GRAIN MILL PRODUCTS

Tertiary Treatment of Combined Domestic and Industrial Wastes – REF. NO. EPA-R2-73-236

SIC 206 SUGAR

Anaerobic-Aerobic Ponds for Beet Sugar Waste Treatment – REF. NO. EPA-R2-73-025
Biological Treatment of Concentrated Sugar Beet Wastes – REF. NO. EPA-660/2-74-028
Separation, Dewatering, and Disposal of Sugar Beet Transport Water Solids Phase I – REF. NO. EPA-660/2-74-093
State-of-Art, Sugarbeet Processing Waste Treatment – REF. NO. EPA-12060DSI07/71

SIC 207 FATS & OILS

Investigation of Odor Control in the Rendering Industry – REF. NO. EPA-R2-72-088
Odor Control by Scrubbing in the Rendering Industry – REF. NO. EPA-600/2-76-009
Recovery of Fatty Materials From Edible Oil Refinery Effluents – REF. NO. EPA-660/2-73-015
Treatment of Effluent Waters from Vegetable Oil Refining – REF. NO. EPA-600/2-76-294

SIC 208 BEVERAGES

Activated Sludge – Bio-Disc Treatment of Distillery Wastewater – REF. NO. EPA-660/2-74-014
Pilot Scale Treatment of Wine Stillage – REF. NO. EPA-660/2-75-002
Rum Distillery Slops Treatment by Anaerobic Contact Process – REF. NO. EPA-660/2-74-074
State of the Art: Wastewater Management in the Beverage Industry – REF. NO. EPA-600/2-77-048
Submerged Combustion Evaporator for Concentration of Brewery Spent Grain Liquor – REF. NO. EPA-660/2-74-059

SIC 209 MISC. FOODS

Current Practice in Seafoods Processing Waste Treatment – REF. NO. EPA-12060ECF04/70
Pollution Abatement and By-Product Recovery in Shellfish and Fisheries Processing – REF. NO. EPA-12130FJQ06/71
Shrimp Canning Waste Treatment Study – REF. NO. EPA-660/2-74-061

SIC 301 RUBBER TIRES

Industrial Wastewater Reclamation with a 400,000-Gallon-Per-Day Vertical Tube Evaporator – REF. NO. EPA-600/2-76-260

SIC 311 TANNING

Activated Sludge Treatment of Chrome Tannery Wastes – REF. NO. EPA-12120--09/69
Anaerobic-Aerobic Lagoon Treatment for Vegetable Tanning Wastes – REF. NO. EPA-12120DIK12/70
Leather Tannery Waste Management Through Process Change, Reuse and Pretreatment – REF. NO. EPA-600/2-77-034
Leather Tanning and Finishing Waste Management Research and Development Program – REF. NO. EPA-600/2-76-230
Secondary Waste Treatment for a Small Diversified Tannery – REF. NO. EPA-R2-73-209
Treatment of Sole Leather Vegetable Tannery Wastes – REF. NO. EPA-12120--09/70

SIC 321 FLAT GLASS

Environmental Considerations of Selected Energy Conserving Manufacturing Process Options. Vol. XI. Glass Industry Report – REF. NO. EPA-600/7-76-034k
Source Assessment: Flat Glass Manufacturing Plants – REF. NO. EPA-600/2-76-032b

SIC 322 GLASS PRODUCTS

Source Assessment: Glass Container Manufacturing Plants – REF. NO. EPA-600/2-76-269
Source Assessment: Pressed and Blown Glass Manufacturing Plants – REF. NO. EPA-600/2-77-005

SIC INDEX

SIC 324 CEMENT

Disposal and Utilization of Waste Kiln Dust From Cement Industry – REF. NO. EPA-670/2-75-043
Elimination of Water Pollution by Recycling Cement Plant Kiln Dust – REF. NO. EPA-600/2-76-194
Environmental Considerations to Selected Energy Conserving Manufacturing Process Options. Vol. X. Cement Industry Report – REF. NO. EPA-600/7-76-034j
Evaluation of Rexnord Gravel Bed Filter – REF. NO. EPA-600/2-76-164
Industrial Process Profiles for Environmental Use: Chapter 21. The Cement Industry – REF. NO. EPA-600/2-77-023u
Technical Manual for Measurement of Fugitive Emissions: Upwind/Downwind Sampling Method for Industrial Emissions – REF. NO. EPA-600/2-76-089a
Trace Pollutant Emissions from the Processing of Non-Metallic Ores – REF. NO. EPA-650/2-74-122

SIC 325 STRUCTURAL CLAY

Industrial Process Profiles for Environmental Use: Chapter 19. The Clay Industry – REF. NO. EPA-600/2-77-023s

SIC 327 CONCRETE

Industrial Process Profiles for Environmental Use: Chapter 17. The Gypsum and Wallboard Industry – REF. NO. EPA-600/2-77-023q
Industrial Process Profiles for Environmental Use: Chapter 18. The Lime Industry – REF. NO. EPA-600/2-77-023r
Screening Study for Background Information and Significant Emissions from Gypsum Product Manufacturing – REF. NO. EPA-R2-73-286
Wastewater Treatment Studies in Aggregate and Concrete Products – REF. NO. EPA-R2-73-003

SIC 328 STONE

Granite Industry Wastewater Treatment – REF. NO. EPA-660/2-74-040
State of the Art: Sand and Gravel Industry – REF. NO. EPA-660/2-74-066

SIC 329 ASBESTOS

Asbestos Fiber Atlas – REF. NO. EPA-650/2-75-036
Assessment of Particle Control Technology for Enclosed Asbestos Sources—Phase II – REF. NO. EPA-600/2-76-065
Assessment of Particle Control Technology for Enclosed Asbestos Sources – REF. NO. EPA-650/2-74-088
Characterization and Control of Asbestos Emissions from Open Sources – REF. NO. EPA-650/2-74-090
Evaluation of Electron Microscopy for Process Control in the Asbestos Industry – REF. NO. EPA-600/2-77-059
Identification and Assessment of Asbestos Emissions from Incidental Sources of Asbestos – REF. NO. EPA-650/2-74-087
Industrial Process Profiles for Environmental Use: Chapter 20. The Mica Industry – REF. NO. EPA-600/2-77-023t
Johns-Manville CHEAF Evaluation – REF. NO. EPA-650/2-75-058a
Phenolic Water Reuse by Diatomite Filtration – REF. NO. EPA-12080EZF09/70

SIC 330 PRIMARY METALS

Energy Consumption: The Primary Metals and Petroleum Industries – REF. NO. EPA-650/2-75-032b

SIC 333 NON-FERROUS

Assessment of Technology for Possible Utilization of Bayer Process Muds – REF. NO. EPA-600/2-76-301
Control of Sulfur Dioxide Emissions from Copper Smelters: Volume I – Steam Oxidation of Pyritic Copper Concentrates – REF. NO. EPA-650/2-74-085a
Control of Sulfur Dioxide Emissions from Copper Smelters: Volume II – Hydrogen Sulfide Production from Copper Concentrates – REF. NO. EPA-650/2-74-085b
Copper – REF. NO. EPA-600/1-77-003
Design and Operating Parameters for Emission Control Studies: White Pine Copper Smelter – REF. NO. EPA-600/2-76-036a
Design and Operating Parameters for Emission Control Studies: Kennecott, Hayden, Copper Smelter – REF. NO. EPA-600/2-76-036b
Design and Operating Parameters for Emission Control Studies: Kennecott, McGill, Copper Smelter – REF. NO. EPA-600/2-76-036c
Design and Operating Parameters for Emission Control Studies: Kennecott, Hurley, Copper Smelter – REF. NO. EPA-600/2-76-036d
Design and Operating Parameters for Emission Control Studies: Magma, San Manuel, Copper Smelter – REF. NO. EPA-600/2-76-036e
Design and Operating Parameters for Emission Control Studies: Phelps Dodge, Ajo, Copper Smelter – REF. NO. EPA-600/2-76-036f
Design and Operating Parameters for Emission Control Studies: Phelps Dodge, Morenci, Copper Smelter – REF. NO. EPA-600/2-76-036g
Design and Operating Parameters for Emission Control Studies: Phelps Dodge, Douglas, Copper Smelter – REF. NO. EPA-600/2-76-036h
Design and Operating Parameters for Emission Control Studies: ASARCO, El Paso, Copper Smelter – REF. NO. EPA-600/2-76-036i
Design and Operating Parameters for Emission Control Studies: ASARCO, Hayden, Copper Smelter – REF. NO. EPA-600/2-76-036j

SIC INDEX

SIC 333 NON-FERROUS

Design and Operating Parameters for Emission Control Studies: ASARCO, Tacoma, Copper Smelter – REF. NO. EPA-600/2-76-036k
Determination of Hazardous Elements in Smelter-Produced Sulfuric Acid – REF. NO. EPA-650/2-74-131
Environmental Considerations of Selected Energy Conserving Manufacturing Process Options. Vol. VIII. Alumina/Aluminum Industry Report – REF. NO. EPA-600/7-76-034h
Environmental Considerations of Selected Energy Conserving Manufacturing Process Options. Vol. XIV. Primary Copper Industry Report – REF. NO. EPA-600/7-76-034n
Industrial Process Profiles for Environmental Use: Chapter 25. Primary Aluminum Industry – REF. NO. EPA-600/2-77-023y
Industrial Process Profiles for Environmental Use: Chapter 26. Titanium Industry – REF. NO. EPA-600/2-77-023z
Measurement of Sulfur Dioxide, Particulate, and Trace Elements in Copper Smelter Converter and Roaster/Reverberatory Gas Streams – REF. NO. EPA-650/2-74-111
Methodology for Assessing Environmental Implications and Technologies: Nonferrous Metals Industries – REF. NO. EPA-600/2-76-303
Process Modifications for Control of Particulate Emissions from Stationary Combustion, Incineration, and Metals – REF. NO. EPA-650/2-74-100
Reclamation of Sulfuric Acid From Waste Streams – REF. NO. EPA-670/2-75-016
Systems Study of Conventional Combustion Sources in the Primary Aluminum Industry – REF. NO. EPA-R2-73-191
SO_2 Control Processes for Non-Ferrous Smelters – REF. NO. EPA-600/2-76-008
Trace Pollutant Emissions from the Processing of Metallic Ores – REF. NO. EPA-650/2-74-115
Treatment and Recovery of Fluoride Industrial Waste – REF. NO. EPA-660/2-73-024
Water Pollution Control in the Primary Nonferrous Metals Industry, Vol. I – Copper, Zinc, and Lead Industries – REF. NO. EPA-R2-73-247a
Water Pollution Control in the Primary Nonferrous Metals Industry, Vol. II – Aluminum, Mercury, Gold, Silver, Molybdenum, and Tungsten – REF. NO. EPA-R2-73-247b

SIC 334 SMELTING NON-FERROUS

Metallic Recovery From Waste Waters Utilizing Cementation – REF. NO. EPA-670/2-74-008
Operation of a Sulfuric Acid Plant Using Blended Copper Smelter Gases – REF. NO. EPA-600/2-76-199
Regeneration of Chromated Aluminum Deoxidizers – REF. NO. EPA-660/2-73-023

SIC 335 ROLLING NON-FERROUS

Brass Wire Mill Process Changes and Waste Abatement, Recovery and Reuse – REF. NO. EPA-12010DPF11/71
Copper Recovery from Brass Mill Discharge by Cementation with Scrap Iron – REF. NO. EPA-670/2-75-029

SIC 347 COATING

Chemical Treatment of Plating Waste for Removal of Heavy Metals – REF. NO. EPA-R2-73-044
Electrolytic Treatment of Job Shop Metal Finishing Wastewater – REF. NO. EPA-600/2-75-028
Foam Flotation Treatment of Heavy Metals and Fluoride-Bearing Industrial Wastewaters – REF. NO. EPA-600/2-77-072
Investigation of Techniques for Removal of Chromium from Electroplating Wastes – REF. NO. EPA-12010EIE03/71
Investigation of Techniques for Removal of Cyanide from Electroplating Wastes – REF. NO. EPA-12010EIE11/71
Investigation of Treating Electroplaters Cyanide Waste by Electrodialysis – REF. NO. EPA-R2-73-287
Laboratory Study of Continuous Electro-oxidation of Dilute Cyanide Waste – REF. NO. EPA-670/2-74-059
Metal Removal and Cyanide Destruction in Plating Wastewaters Using Particle Bed Electrodes – REF. NO. EPA-600/2-76-296
New Membranes for Reverse Osmosis Treatment of Metal Finishing Effluents – REF. NO. EPA-660/2-73-033
New Membranes for Treating Metal Finishing Effluents by Reverse Osmosis – REF. NO. EPA-600/2-76-197
Reclamation of Metal Values from Metal-Finishing Waste Treatment Sludges – REF. NO. EPA-670/2-75-018
Removal of Chromium from Plating Rinse Water Using Activated Carbon – REF. NO. EPA-670/2-75-055
Reverse Osmosis Field Test: Treatment of Watts Nickel Rinse Waters – REF. NO. EPA-600/2-77-039
Source Assessment Prioritization of Air Pollution from Industrial Surface Coating Operations – REF. NO. EPA-650/2-75-019a
State of the Art Review of Metal Finishing Waste Treatment – REF. NO. EPA-12010EIE11/68
Thor V Solventless Metal Decorating for Three-Piece Cans— Background – REF. NO. EPA-600/2-76-011
Treatment of Elctroplating Wastes by Reverse Osmosis – REF. NO. EPA-600/2-76-261
Treatment of Metal Finishing Wastes by Sulfide Precipitation – REF. NO. EPA-600/2-77-049
Ultrathin Membranes for Treating Metal Finishing Effluents by Reverse Osmosis – REF. NO. EPA-12010DRH11/71
Waste Water Treatment and Reuse in a Metal Finishing Job Shop – REF. NO. EPA-670/2-74-042
Zinc Sludge Recycling After Kastone-R Treatment of Cyanide-Bearing Rinse Water – REF. NO. EPA-600/2-77-038

SIC 241 FORESTRY & LOGGING

Effects of Log Handling and Storage of Water Quality – REF. NO. EPA-600/2-76-262
Forest Fertilization—A State of the Art Review and Description of Environmental Effects – REF. NO. EPA-R2-72-016

SIC INDEX

SIC 241 FORESTRY & LOGGING

Industrial Waste Guide on Logging Practices – REF. NO. EPA-13010---02/70
Influence of Log Handling on Water Quality – REF. NO. EPA-R2-73-085
Studies on Effects of Watershed Practices on Streams – REF. NO. EPA-13010EGA02/71

SIC 242 SAWMILLS

Clean Fuels from Agricultural and Forestry Wastes – REF. NO. EPA-600/2-76-090
Utilization of Bark Wastes – REF. NO. EPA-670/2-73-005

SIC 249 MISC. WOOD PRODUCTS

Aerobic Secondary Treatment of Plywood Glue Wastes – REF. NO. EPA-R2-73-195
Treating Wood Preserving Plant Wastewater by Chemical and Biological Methods – REF. NO. EPA-600/2-76-231

SIC 260 PAPER & ALLIED PRODUCTS

Methods for Pulp and Paper Mill Sludge Utilization and Disposal – REF. NO. EPA-R2-73-232
State-of-the-Art Review of Pulp and Paper Waste Treatment – REF. NO. EPA-R2-73-184

SIC 261 PULP MILLS

Activated Carbon Treatment of Unbleached Kraft Effluent for Reuse – REF. NO. EPA-660/2-75-004
Aerated Lagoon Treatment of Sulfite Pulping Effluents – REF. NO. EPA-12040ELW12/70
Aerial Photographic Tracing of Pulp Mill Effluent in Marine Waters – REF. NO. EPA-12040EBY08/70
Analysis of Organic Compounds in Two Kraft Mill Wastewaters – REF. NO. EPA-660/4-75-005
Coliform Bacteria Growth and Control in Aerated Stabilization Basins – REF. NO. EPA-660/2-73-028
Color Characterization Before and After Lime Treatment – REF. NO. EPA-660/2-74-029
Color Removal and Sludge Disposal Process for Kraft Mill Effluents – REF. NO. EPA-660/2-74-008
Color Removal from Kraft Pulp Mill Effluents by Massive Lime Treatment – REF. NO. EPA-R2-73-086
Color Removal from Kraft Pulping Effluent by Lime Addition – REF. NO. EPA-12040ENC12/71
Color Removal From Kraft Mill Effluents By Ultrafiltration – REF. NO. EPA-660/2-73-019
Design Considerations for Pulp and Paper-Mill Sludge Landfills – REF. NO. EPA-600/3-76-111
Dilute Spent Kraft Liquor Filtration through Wood Chips – REF. NO. EPA-12040EZZ04/70
Environmental Considerations of Selected Energy Conserving Manufacturing Process Options. Vol. V. Pulp and Paper Industry Report – REF. NO. EPA-600/7-76-034e
Improved Air Pollution Control for a Kraft Recovery Boiler: Recovery Boiler No. 4 – REF. NO. EPA-650/2-74-071b
Improved Air Pollution Control for Kraft Recovery Boiler: Modified Recovery Boiler No. 3 – REF. NO. EPA-650/2-74-071a
Indigester Black Liquor Oxidation for Odor Control in Kraft Pulping – REF. NO. EPA-650/2-74-005
Ion Exchange Color and Mineral Removal from Kraft Bleach Wastes – REF. NO. EPA-R2-73-255
Joint Municipal and Semichemical Pulping Wastes – REF. NO. EPA-11060EOC07/69
Kraft Effluent Color Characterization Before and After Stoichiometric Lime Treatment – REF. NO. EPA-R2-73-141
Kraft Pulping Effluent Treatment and Reuse – State of the Art – REF. NO. EPA-R2-73-164
Mercury Recovery from Contaminated Waste Waters and Sludges – REF. NO. EPA-660/2-74-086
Organic Compounds in Pulp Mill Lagoon Discharge – REF. NO. EPA-660/2-75-028
Removal of Soluble BODs in Primary Clarifiers – REF. NO. EPA-600/2-76-221
Slime Growth Evaluation of Treated Pulp Mill Waste – REF. NO. EPA-12040DLQ08/71
Steam Stripping Odorous Substances from Kraft Effluent Streams – REF. NO. EPA-R2-73-196
Studies of Low Molecular Weight Lignin Sulfonates – REF. NO. EPA-660/2-74-069
Test Method for Volatile Component Stripping of Wastewater – REF. NO. EPA-660/2-74-044
Treatment of Domestic Wastewater and NSSC Pulp and Paper Mill Wastes – REF. NO. EPA-660/2-73-010
Treatment of Sulfite Evaporator Condensates for Recovery of Volatile Components – REF. NO. EPA-660/2-73-030

SIC 262 PAPER MILLS

Foam Separation of Kraft Pulping Wastes – REF. NO. EPA-12040EUG10/69
Joint Treatment of Municipal Sewage and Pulp Mill Effluents – REF. NO. EPA-12130FDX07/70
Multi-System Biological Treatment of Bleached Kraft Effluents – REF. NO. EPA-12040EMY12/71
Papermill Wastewater Treatment by Microstraining – REF. NO. EPA-600/2-76-252
Particulate Collection Efficiency Measurements on an Electrostatic Precipitator Installed on a Paper Mill Recovery Boiler – REF. NO. EPA-600/2-76-141
Recycle of Papermill Waste Waters and Application of Reverse Osmosis – REF. NO. EPA-12040FUB01/72

SIC INDEX

SIC 262 PAPER MILLS

Reverse Osmosis Concentration of Dilute Pulp and Paper Effluents – REF. NO. EPA-12040EEL02/72
Sludge Material Recovery System for Manufacturers of Pigmented Papers – REF. NO. EPA-12040FES07/71
Treatment of Selected Internal Kraft Mill Wastes in a Cooling Tower – REF. NO. EPA-12040EEK08/71

SIC 263 PAPERBOARD MILLS

Combined Treatment of Municipal Kraft Linerboard and Fiberboard Manufacturing Wastes – REF. NO. EPA-11060DPD02/71
Pollution Abatement by Fiber Modification – REF. NO. EPA-12040EFC01/71
Taxonomy of *Klebsiella pneumoniae* Isolated From Pulp/Paper Mill Wastewater – REF. NO. EPA-660/2-75-024
Water Reuse in a Paper Reprocessing Plant – REF. NO. EPA-600/2-76-232

SIC 494 WATER SUPPLY

Industrial Water Softener Waste Brine Reclamation – REF. NO. EPA-660/2-74-007
Plant Scale Studies of the Magnesium Carbonate Water Treatment Process – REF. NO. EPA-660/2-75-006

SIC 495 SANITARY SERVICES

Physical-Chemical Treatment of Municipal Wastes by Recycled Magnesium Carbonate – REF. NO. EPA-660/2-74-055

SIC 721 LAUNDRY WASTES

Modular Wastewater Treatment System Demonstration for the Textile Maintenance Industry – REF. NO. EPA-660/2-73-037
Treatment of Laundromat Wastes – REF. NO. EPA-R2-73-108
>

TITLE INDEX

Activated Carbon Treatment of Unbleached Kraft Effluent for Reuse – REF. NO. EPA-660/2-75-004
Activated Sludge – Bio-Disc Treatment of Distillery Wastewater – REF. NO. EPA-660/2-74-014
Activated Sludge Treatment of Chrome Tannery Wastes – REF. NO. EPA-12120---09/69
Aerated Lagoon Treatment of Food Processing Wastes – REF. NO. EPA-12060---03/68*
Aerated Lagoon Treatment of Sulfite Pulping Effluents – REF. NO. EPA-12040ELW12/70
Aerial Photographic Tracing of Pulp Mill Effluent in Marine Waters – REF. NO. EPA-12040EBY08/70
Aerobic Secondary Treatment of Plywood Glue Wastes – REF. NO. EPA-R2-73-195
Aerobic Secondary Treatment of Potato Processing Wastes – REF. NO. EPA-12060EHV12/70
Aerobic Treatment of Fruit Processing Wastes – REF. NO. EPA-12060FAD10/69
Air Flotation – Biological Oxidation of Synthetic Rubber and Latex Wastewater – REF. NO. EPA-660/2-73-018
Anaerobic and Aerobic Treatment of Combined Potato Processing Municipal Wastes – REF. NO. EPA-600/2-76-236
Anaerobic Treatment of Synthetic Organic Wastes – REF. NO. EPA-12020DIS01/72
Anaerobic-Aerobic Lagoon Treatment for Vegetable Tanning Wastes – REF. NO. EPA-12120DIK12/70
Anaerobic-Aerobic Ponds for Beet Sugar Waste Treatment – REF. NO. EPA-R2-73-025
Analysis of Organic Compounds in Two Kraft Mill Wastewaters – REF. NO. EPA-660/4-75-005
Asbestos Fiber Atlas – REF. NO. EPA-650/2-75-036
Assessment of Particle Control Technology for Enclosed Asbestos Sources—Phase II – REF. NO. EPA-600/2-76-065
Assessment of Particle Control Technology for Enclosed Asbestos Sources – REF. NO. EPA-650/2-74-088
Assessment of Technology for Possible Utilization of Bayer Process Muds – REF. NO. EPA-600/2-76-301
Biological Treatment of Chlorophenolic Wastes – REF. NO. EPA-12130EGK06/71
Biological Treatment of Concentrated Sugar Beet Wastes – REF. NO. EPA-660/2-74-028
Brass Wire Mill Process Changes and Waste Abatement, Recovery and Reuse – REF. NO. EPA-12010DPF11/71
Cannery Waste Biological Sludge Disposal as Cattle Feed – REF. NO. EPA-600/2-76-253
Cannery Waste Treatment by Anaerobic Lagoons and Oxidation Ditch – REF. NO. EPA-R2-73-017
Cannery Waste Treatment Kehr Activated Sludge – REF. NO. EPA-12060EZP09/70
Cannery Wastewater Treatment with Rotating Biological Contactor and Extended Aeration – REF. NO. EPA-R2-73-024
Characterization and Control of Asbestos Emissions from Open Sources – REF. NO. EPA-650/2-74-090
Characterization of Atmospheric Emissions from Polyurethane Resin Manufacture – REF. NO. EPA-650/2-74-107
Characterization of Waste Waters from the Ethical Pharmaceutical Industry – REF. NO. EPA-670/2-74-057
Chemical Treatment of Plating Waste for Removal of Heavy Metals – REF. NO. EPA-R2-73-044
Clean Fuels from Agricultural and Forestry Wastes – REF. NO. EPA-600/2-76-090
Coliform Bacteria Growth and Control in Aerated Stabilization Basins – REF. NO. EPA-660/2-73-028
Color Characterization Before and After Lime Treatment – REF. NO. EPA-660/2-74-029
Color Removal and Sludge Disposal Process for Kraft Mill Effluents – REF. NO. EPA-660/2-74-008
Color Removal from Kraft Pulp Mill Effluents by Massive Lime Treatment – REF. NO. EPA-R2-73-086
Color Removal from Kraft Pulping Effluent by Lime Addition – REF. NO. EPA-12040ENC12/71
Color Removal From Kraft Mill Effluents By Ultrafiltration – REF. NO. EPA-660/2-73-019
Combined Treatment of Domestic and Industrial Wastes by Activated Sludge – REF. NO. EPA-12130EZR05/71
Combined Treatment of Municipal Kraft Linerboard and Fiberboard Manufacturing Wastes – REF. NO. EPA-11060DPD02/71
Complete Mix Activated Sludge Treatment of Citrus Process Wastes – REF. NO. EPA-12060EZY08/71
Construction of a Prototype Sulfuric Acid Mist Monitor – REF. NO. EPA-600/2-76-211
Continuous Inplant Hot Gas Blanching of Vegetables – REF. NO. EPA-660/2-74-091
Control of Sulfur Dioxide Emissions from Copper Smelters: Volume I – Steam Oxidation of Pyritic Copper Concentrates – REF. NO. EPA-650/2-74-085a
Control of Sulfur Dioxide Emissions from Copper Smelters: Volume II – Hydrogen Sulfide Production from Copper Concentrates – REF. NO. EPA-650/2-74-085b
Converting Chlorohydrocarbon Wastes by Chlorolysis – REF. NO. EPA-600/2-76-270
Copper – REF. NO. EPA-600/1-77-003
Copper Recovery from Brass Mill Discharge by Cementation with Scrap Iron – REF. NO. EPA-670/2-75-029
Current Practice in Potato Processing Waste Treatment – REF. NO. EPA-12060---10/69
Current Practice in Seafoods Processing Waste Treatment – REF. NO. EPA-12060ECF04/70
Dairy Food Plant Wastes and Waste Treatment Practices – REF. NO. EPA-12060EGU03/71
Demonstration of a Full-Scale Waste Treatment System for a Cannery – REF. NO. EPA-12060DSB09/71
Design and Operating Parameters for Emission Control Studies: White Pine Copper Smelter – REF. NO. EPA-600/2-76-036a
Design and Operating Parameters for Emission Control Studies: Kennecott, Hayden, Copper Smelter – REF. NO. EPA-600/2-76-036b
Design and Operating Parameters for Emission Control Studies: Kennecott, McGill, Copper Smelter – REF. NO. EPA-600/2-76-036c
Design and Operating Parameters for Emission Control Studies: Kennecott, Hurley, Copper Smelter – REF. NO. EPA-600/2-76-036d
Design and Operating Parameters for Emission Control Studies: Magma, San Manuel, Copper Smelter – REF. NO. EPA-600/2-76-036e
Design and Operating Parameters for Emission Control Studies: Phelps Dodge, Ajo, Copper Smelter – REF. NO. EPA-600/2-76-036f
Design and Operating Parameters for Emission Control Studies: Phelps Dodge, Morenci, Copper Smelter – REF. NO. EPA-600/2-76-036g
Design and Operating Parameters for Emission Control Studies: Phelps Dodge, Douglas, Copper Smelter – REF. NO. EPA-600/2-76-036h
Design and Operating Parameters for Emission Control Studies: ASARCO, El Paso, Copper Smelter – REF. NO. EPA-600/2-76-036i
Design and Operating Parameters for Emission Control Studies: ASARCO, Hayden, Copper Smelter – REF. NO. EPA-600/2-76-036j
Design and Operating Parameters for Emission Control Studies: ASARCO, Tacoma, Copper Smelter – REF. NO. EPA-600/2-76-036k

TITLE INDEX

Design Considerations for Pulp and Paper-Mill Sludge Landfills – REF. NO. EPA-600/3-76-111
Determination of Hazardous Elements in Smelter-Produced Sulfuric Acid – REF. NO. EPA-650/2-74-131
Dialysis for Concentration and Removal of Industrial Wastes – REF. NO. EPA-600/2-76-223
Dilute Spent Kraft Liquor Filtration through Wood Chips – REF. NO. EPA-12040EZZ04/70
Disposal and Utilization of Waste Kiln Dust From Cement Industry – REF. NO. EPA-670/2-75-043
Dry Caustic Heating of Clingstone Peaches on a Commercial Scale – REF. NO. EPA-660/2-74-092
Dry Caustic Peeling of Tree Fruit for Liquid Waste Reduction – REF. NO. EPA-12060FQE12/70
Effect of Chlorination on Selected Organic Chemicals – REF. NO. EPA-12020EXG03/72
Effect of Equipment Maintenance and Age on Sulfuric Acid Plant Emissions – REF. NO. EPA-600/2-76-119
Effects of Log Handling and Storage of Water Quality – REF. NO. EPA-600/2-76-262
Egg Breaking and Processing Waste Control and Treatment – REF. NO. EPA-660/2-75-019
Electrolytic Treatment of Job Shop Metal Finishing Wastewater – REF. NO. EPA-600/2-75-028
Elimination of pollution from Cottage Cheese Whey by Drying and Utilization – REF. NO. EPA-600/2-76-254
Elimination of Water Pollution by Packing-house Animal Paunch and Blood – REF. NO. EPA-12060FDS11/71
Elimination of Water Pollution by Recycling Cement Plant Kiln Dust – REF. NO. EPA-600/2-76-194
Energy Consumption: Fuel Utilization and Conservation in Industry – REF. NO. EPA-650/2-75-032d
Energy Consumption: Paper, Stone/Clay/Glass/Concrete, and Food Industries – REF. NO. EPA-650/2-75-032c
Energy Consumption: The Chemical Industry – REF. NO. EPA-650/2-75-032a
Energy Consumption: The Primary Metals and Petroleum Industries – REF. NO. EPA-650/2-75-032b
Environmental Catalog of Industrial Processes; Volume II— Industrial Organic Chemicals – REF. NO. EPA-600/2-76-051b
Environmental Consideration of Selected Energy Conserving Manufacturing Process Options. Vol. I. Industry Summary Report – REF. NO. EPA-600/7-76-034a
Environmental Considerations fo Selected Energy Conserving Manufacturing Process Options. Vol. X. Cement Industry Report – REF. NO. EPA-600/7-76-034j
Environmental Considerations of Selected Energy Conserving Manufacturing Process Options. Vol. II. Industry Priority Report – REF. NO. EPA-600/7-76-034b
Environmental Considerations of Selected Energy Conserving Manufacturing Process Options. Vol. V. Pulp and Paper Industry Report – REF. NO. EPA-600/7-76-034e
Environmental Considerations of Selected Energy Conserving Manufacturing Process Options. Vol. VI. Olefins Industry Report – REF. NO. EPA-600/7-76-034f
Environmental Considerations of Selected Energy Conserving Manufacturing Process Options. Vol. VIII. Alumina/Aluminum Industry Report – REF. NO. EPA-600/7-76-034h
Environmental Considerations of Selected Energy Conserving Manufacturing Process Options. Vol. XII. Chlor-Alkali Industry Report – REF. NO. EPA-600/7-76-0341
Environmental Considerations of Selected Energy Conserving Manufacturing Process Options. Vol. XIII. Phosphorus/ Phosphoric Acid Industry Report – REF. NO. EPA-600/7-76-034m
Environmental Considerations of Selected Energy Conserving Manufacturing Process Options. Vol. XIV. Primary Copper Industry Report – REF. NO. EPA-600/7-76-034n
Environmental Considerations of Selected Energy Conserving Manufacturing Process Options. Vol. XI. Glass Industry Report – REF. NO. EPA-600/7-76-034k
Evaluation and Upgrading of a Multi-Stage Trickling Filter Facility – REF. NO. EPA-600/2-76-195
Evaluation of Electron Microscopy for Process Control in the Asbestos Industry – REF. NO. EPA-600/2-77-059
Evaluation of Polymeric Clarification of Meat-Packing and Domestic Wastewaters – REF. NO. EPA-660/2-74-020
Evaluation of Rexnord Gravel Bed Filter – REF. NO. EPA-600/2-76-164
Fluidized-Bed Incineration of Selected Carbonaceous Industrial Wastes – REF. NO. EPA-12120FYF03/72
Fluoride Emissions from Phosphoric Acid Plant Gypsum Ponds – REF. NO. EPA-650/2-74-095
Foam Flotation Treatment of Heavy Metals and Fluoride-Bearing Industrial Wastewaters – REF. NO. EPA-600/2-77-072
Foam Separation of Kraft Pulping Wastes – REF. NO. EPA-12040EUG10/69
Forest Fertilization—A State of the Art Review and Description of Environmental Effects – REF. NO. EPA-R2-72-016
Granite Industry Wastewater Treatment – REF. NO. EPA-660/2-74-040
Hydrocarbon Emissions Reduction From Ethylene Dichloride Processes – REF. NO. EPA-600/2-76-053
Identification and Assessment of Asbestos Emissions from Incidental Sources of Asbestos – REF. NO. EPA-650/2-74-087
Identification and Control of Petrochemical Pollutants Inhibitory to Anaerobic Processes – REF. NO. EPA-R2-73-194
Improved Air Pollution Control for a Kraft Recovery Boiler: Recovery Boiler No. 4 – REF. NO. EPA-650/2-74-071b
Improved Air Pollution Control for Kraft Recovery Boiler: Modified Recovery Boiler No. 3 – REF. NO. EPA-650/2-74-071a
Improvement of Treatment of Food Industry Waste – REF. NO. EPA-660/2-74-035
Indigester Black Liquor Oxidation for Odor Control in Kraft Pulping – REF. NO. EPA-650/2-74-005
Industrial Process Profiles for Environmental Use: Chapter 10. Plastics and Resins Industry – REF. NO. EPA-600/2-77-023j
Industrial Process Profiles for Environmental Use: Chapter 12. The Explosives Industry – REF. NO. EPA-600/2-77-0231
Industrial Process Profiles for Environmental Use: Chapter 13. Plasticizers Industry – REF. NO. EPA-600/2-77-023m
Industrial Process Profiles for Environmental Use: Chapter 15. Brine and Evaporite Chemicals Industry – REF. NO. EPA-600/2-77-023o
Industrial Process Profiles for Environmental Use: Chapter 16. The Fluorocarbon-Hydrogen Floride Industry – REF. NO. EPA-600/2-77-023p
Industrial Process Profiles for Environmental Use: Chapter 17. The Gypsum and Wallboard Industry – REF. NO. EPA-600/2-77-023q
Industrial Process Profiles for Environmental Use: Chapter 18. The Lime Industry – REF. NO. EPA-600/2-77-023r
Industrial Process Profiles for Environmental Use: Chapter 19. The Clay Industry – REF. NO. EPA-600/2-77-023s
Industrial Process Profiles for Environmental Use: Chapter 20. The Mica Industry – REF. NO. EPA-600/2-77-023t
Industrial Process Profiles for Environmental Use: Chapter 21. The Cement Industry – REF. NO. EPA-600/2-77-023u

TITLE INDEX

Industrial Process Profiles for Environmental Use: Chapter 23. Sulfur, Sulfur Oxides and Sulfuric Acid – REF. NO. EPA-600/2-77-023w
Industrial Process Profiles for Environmental Use: Chapter 25. Primary Aluminum Industry – REF. NO. EPA-600/2-77-023y
Industrial Process Profiles for Environmental Use: Chapter 26. Titanium Industry – REF. NO. EPA-600/2-77-023z
Industrial Process Profiles for Environmental Use: Chapter 6. The Industrial Organic Chemicals Industry – REF. NO. EPA-600/2-77-023f
Industrial Process Profiles for Environmental Use: Chapter 7. Organic Dyes and Pigments Industry – REF. NO. EPA-600/2-77-023g
Industrial Process Profiles for Environmental Use: Chapter 9. The Synthetic Rubber Industry – REF. NO. EPA-600/2-77-023i
Industrial Waste Guide on Logging Practices – REF. NO. EPA-13010---02/70
Industrial Wastewater Reclamation with a 400,000-Gallon-Per-Day Vertical Tube Evaporator – REF. NO. EPA-600/2-76-260
Industrial Water Softener Waste Brine Reclamation – REF. NO. EPA-660/2-74-007
Influence of Log Handling on Water Quality – REF. NO. EPA-R2-73-085
Infrared Dry Caustic vs. Wet Caustic Peeling of White Potatoes – REF. NO. EPA-660/2-74-088
Inorganic Chemicals Industry Profile – REF. NO. EPA-12020EJI07/71
Investigation of Odor Control in the Rendering Industry – REF. NO. EPA-R2-72-088
Investigation of Techniques for Removal of Chromium from Electroplating Wastes – REF. NO. EPA-12010EIE03/71
Investigation of Techniques for Removal of Cyanide from Electroplating Wastes – REF. NO. EPA-12010EIE11/71
Investigation of Treating Electroplaters Cyanide Waste by Electrodialysis – REF. NO. EPA-R2-73-287
Ion Exchange Color and Mineral Removal from Kraft Bleach Wastes – REF. NO. EPA-R2-73-255
Ion Exchange Process for Recovery of Chromate from Pigment Manufacturing – REF. NO. EPA-670/2-74-044
IERL-RTP Procedures Manual: Level 1 Environmental Assessment – REF. NO. EPA-600/2-76-160a
Johns-Manville CHEAF Evaluation – REF. NO. EPA-650/2-75-058a
Joint Municipal and Semichemical Pulping Wastes – REF. NO. EPA-11060EOC07/69
Joint Treatment of Municipal Sewage and Pulp Mill Effluents – REF. NO. EPA-12130EDX07/70
Kraft Effluent Color Characterization Before and After Stoichiometric Lime Treatment – REF. NO. EPA-R2-73-141
Kraft Pulping Effluent Treatment and Reuse – State of the Art – REF. NO. EPA-R2-73-164
Laboratory Study of Continous Electro-oxidation of Dilute Cuanide Waste – REF. NO. EPA-670/2-74-059
Leather Tannery Waste Management Through Process Change, Reuse and Pretreatment – REF. NO. EPA-600/2-77-034
Leather Tanning and Finishing Waste Management Research and Development Program – REF. NO. EPA-600/2-76-230
Liquid Wastes from Canning and Freezing Fruits and Vegetables – REF. NO. EPA-12060EDK08/71
Low Water Volume Enzyme Deactivation of Vegetables Before Preservation – REF. NO. EPA-R2-73-198
Measurement of Sulfur Dioxide, Particulate, and Trace Elements in Copper Smelter Converter and Roaster/Reverberatory Gas Streams – REF. NO. EPA-650/2-74-111
Membrane Processing of Cottage Cheese Whey for Pollution Abatement – REF. NO. EPA-12060DXF07/71
Mercury Recovery from Contaminated Waste Waters and Sludges – REF. NO. EPA-660/2-74-086
Metal Removal and Cyanide Destruction in Plating Wastewaters Using Particle Bed Electrodes – REF. NO. EPA-600/2-76-296
Metallic Recovery From Waste Waters Utilizing Cementation – REF. NO. EPA-670/2-74-008
Methodology for Assessing Environmental Implications and Technologies: Nonferrous Metals Industries – REF. NO. EPA-600/2-76-303
Methods for Pulp and Paper Mill Sludge Utilization and Disposal – REF. NO. EPA-R2-73-232
Modular Wastewater Treatment System Demonstration for the Textile Maintenance Industry – REF. NO. EPA-660/2-73-037
Molecular Sieve Control Process in Sulfuric Acid Plants – REF. NO. EPA-600/2-75-066
Molecular Sieve Mercury Control Process in Chlor-Alkali Plants – REF. NO. EPA-600/2-76-014
Molecular Sieve Tests for Control of Sulfuric Acid Plant Emissions – REF. NO. EPA-600/2-76-047
Multi-System Biological Treatment of Bleached Kraft Effluents – REF. NO. EPA-12040EMY12/71
National Meat-Packing Waste Management Research and Development Program – REF. NO. EPA-R2-73-178
Naval Stores Wastewater Pruification and Reuse by Activated Carbon Treatment – REF. NO. EPA-600/2-76-227
Neutralization of Abatement Derived Sulfuric Acid – REF. NO. EPA-R2-73-187
New Membranes for Reverse Osmosis Treatment of Metal Finishing Effluents – REF. NO. EPA-660/2-73-033
New Membranes for Treating Metal Finishing Effluents by Reverse Osmosis – REF. NO. EPA-600/2-76-197
Odor Control by Scrubbing in the Rendering Industry – REF. NO. EPA-600/2-76-009
Odor Removal from Air by Adsorption on Charcoal – REF. NO. EPA-650/2-74-084
Operation of a Sulfuric Acid Plant Using Blended Copper Smelter Gases – REF. NO. EPA-600/2-76-199
Optimizing a Petrochemical Waste Bio-Oxidation System Through Automation – REF. NO. EPA-660/2-75-021
Organic Compounds in Pulp Mill Lagoon Discharge – REF. NO. EPA-660/2-75-028
Papermill Wastewater Treatment by Microstraining – REF. NO. EPA-600/2-76-252
Particulate Collection Efficiency Measurements on an Electrostatic Precipitator Installed on a Paper Mill Recovery Boiler – REF. NO. EPA-600/2-76-141
Paunch Manure as a Feed Supplement in Channel Catfish Farming – REF. NO. EPA-660/2-74-046
Petrochemical Effluents Treatment Practices – Summary – REF. NO. EPA-12020---02/70
Phenolic Water Reuse by Diatomite Filtration – REF. NO. EPA-12080EZF09/70
Physical-Chemical Treatment of Municipal Wastes by Recycled Magnesium Carbonate – REF. NO. EPA-660/2-74-055
Pilot Plant Installation for Fungal Treatment of Vegetable Canning Wastes – REF. NO. EPA-12060EDZ08/71
Pilot Plant Optimization of Phosphoric Acid Recovery Process – REF. NO. EPA-670/2-75-015
Pilot Scale Treatment of Wine Stillage – REF. NO. EPA-660/2-75-002
Plant Scale Studies of the Magnesium Carbonate Water Treatment Process – REF. NO. EPA-660/2-75-006
Pollution Abatement and By-Product Recovery in Shellfish and Fisheries Processing – REF. NO. EPA-12130FJQ06/71
Pollution Abatement by Fiber Modification – REF. NO. EPA-12040EFC01/71
Polymeric Materials for Treatment and Recovery of Petrochemical Waste – REF. NO. EPA-12020DQC03/71
Potato Waste Treatment (Proceedings of a Symposium) – REF. NO. EPA-12060---03/68

TITLE INDEX

Poultry Processing Wastewater Treatment and Reuses – REF. NO. EPA-660/2-74-060
Proceedings of the Sixth National Symposium on Food Processing Wastes – REF. NO. EPA-600/2-76-224
Proceedings First National Symposium on Food Processing Wastes – REF. NO. EPA-12060---04/70
Proceedings Fourth National Symposium on Food Processing Wastes – REF. NO. EPA-660/2-73-031
Proceedings Second National Symposium on Food Processing Wastes – REF. NO. EPA-12060---03/71
Proceedings Seventh National Symposium on Food Processing Wastes – REF. NO. EPA-600/2-76-304
Proceedings Third National Symposium on Food Processing Wastes – REF. NO. EPA-R2-72-018
Proceedings: Fifth National Symposium on Food Processing Wastes – REF. NO. EPA-660/2-74-058
Process Modifications for Control of Particulate Emissions from Stationary Combustion, Incineration, and Metals – REF. NO. EPA-650/2-74-100
Projected Wastewater Treatment Costs in the Organic Chemicals Industry – REF. NO. EPA-12020GND07/71
Projects in the Industrial Pollution Control Division – December 1974 – REF. NO. EPA-600/2-75-001
Protein Production from Acid Whey VIA Fermentation – REF. NO. EPA-660/2-74-025
Pyrite Depression by Reduction of Solution Oxidation Potential – REF. NO. EPA-12010DIM08/70
Radiation Treatment of High Strength Chlorinated Hydrocarbon Wastes – REF. NO. EPA-660/2-75-017
Reclamation of Metal Values from Metal-Finishing Waste Treatment Sludges – REF. NO. EPA-670/2-75-018
Reclamation of Sulfuric Acid From Waste Streams – REF. NO. EPA-670/2-75-016
Recondition and Reuse of Organically Contaminated Waste Sodium Chloride Brines – REF. NO. EPA-R2-73-200
Reconditioning of Food Processing Brines – REF. NO. EPA-12060EHU03/71
Recovery of Fatty Materials From Edible Oil Refinery Effluents – REF. NO. EPA-660/2-73-015
Recycle of Papermill Waste Waters and Application of Reverse Osmosis – REF. NO. EPA-12040FUB01/72
Reduction of Salt Content of Food Processing Liquid Waste Effluent – REF. NO. EPA-12060DXL01/71
Regeneration of Chromated Aluminum Deoxidizers – REF. NO. EPA-660/2-73-023
Removal of Chromium from Plating Rinse Water Using Activated Carbon – REF. NO. EPA-670/2-75-055
Removal of Soluble BODs in Primary Clarifiers – REF. NO. EPA-600/2-76-221
Renovation of Industrial Inorganic Wastewater by Evaporation with Interface Enhancement – REF. NO. EPA-600/2-76-017
Reverse Osmosis Concentration of Dilute Pulp and Paper Effluents – REF. NO. EPA-12040EEL02/72
Reverse Osmosis Field Test: Treatment of Watts Nickel Rinse Waters – REF. NO. EPA-600/2-77-039
Rum Distillery Slops Treatment by Anaerobic Contact Process – REF. NO. EPA-660/2-74-074
Scientific and Technical Assessment Report on Cadmium – REF. NO. EPA-600/6-75-003
Scientific and Technical Assessment Report on Particulate Polycyclic Organic Matter (PPOM) – REF. NO. EPA-600/6-75-001
Scientific and Technical Assessment Report on Vinyl Chloride and Polyvinyl Chloride – REF. NO. EPA-600/6-75-004
Screening Study for Background Information and Significant Emissions from Gypsum Product Manufacturing – REF. NO. EPA-R2-73-286
Secondary Treatment of Potato Processing Wastes – REF. NO. EPA-12060--07/69
Secondary Waste Treatment for a Small Diversified Tannery – REF. NO. EPA-R2-73-209
Separation, Dewatering, and Disposal of Sugar Beet Transport Water Solids Phase I – REF. NO. EPA-660/2-74-093
Shrimp Canning Waste Treatment Study – REF. NO. EPA-660/2-74-061
Slime Growth Evaluation of Treated Pulp Mill Waste – REF. NO. EPA-12040DLQ08/71
Sludge Material Recovery System for Manufacturers of Pigmented Papers – REF. NO. EPA-12040FES07/71
Solvent Extraction Status Report – REF. NO. EPA-R2-72-073
Source Assessment Prioritization of Air Pollution from Industrial Surface Coating Operations – REF. NO. EPA-650/2-75-019a
Source Assessment: Flat Glass Manufacturing Plants – REF. NO. EPA-600/2-76-032b
Source Assessment: Glass Container Manufacturing Plants – REF. NO. EPA-600/2-76-269
Source Assessment: Pressed and Blown Glass Manufacturing Plants – REF. NO. EPA-600/2-77-005
Source Assessment: Phthalic Anhydride – REF. NO. EPA-600/2-76-032d
State of the Art Review of Metal Finishing Waste Treatment – REF. NO. EPA-12010EIE11/68
State of the Art: Sand and Gravel Industry – REF. NO. EPA-660/2-74-066
State of the Art: Wastewater Management in the Beverage Industry – REF. NO. EPA-600/2-77-048
State of-the-Art: Military Explosives and Propellants Production Industry. Volume III – Wastewater Treatment – REF. NO. EPA-600/2-76-213c
State-of-the-Art Review of Pulp and Paper Waste Treatment – REF. NO. EPA-R2-73-184
State-of-the-Art: Military Explosives and Propellants Production Industry. Volume I – The Military Explosives and Propellants Industry – REF. NO. EPA-600/2-76-213a
State-of-the-Art: Military Explosives and Propellants Production Industry. Volume II – Wastewater Characterization – REF. NO. EPA-600/2-76-213b
State-of-Art, Sugarbeet Processing Waste Treatment – REF. NO. EPA-12060DSI07/71
State-of-The-Art For The Inorganic Chemicals Industry: Commercial Explosives – REF. NO. EPA-600/2-74-009b
State-of-The-Art For The Inorganic Chemicals Industry: Industrial Inorganic Gases – REF. NO. EPA-600/2-74-009c
Steam Stripping Odorous Substances from Kraft Effluent Streams – REF. NO. EPA-R2-73-196
Studies of Low Molecular Weight Lignin Sulfonates – REF. NO. EPA-660/2-74-069
Studies on Effects of Watershed Practices on Streams – REF. NO. EPA-13010EGA02/71
Submerged Combustion Evaporator for Concentration of Brewery Spent Grain Liquor – REF. NO. EPA-660/2-74-059
Sulfuric Acid Plant Emissions During Start-up, Shutdown, and Malfunction – REF. NO. EPA-600/2-76-010
Survey of Emissions and Controls for "Hazardous" and Other Pollutants, A – REF. NO. EPA-R4-73-021
System Analysis of Air Pollutant Emissions from the Chemical/ Plastics Industry – REF. NO. EPA-650/2-74-106
Systems Study of Conventional Combustion Sources in the Primary Aluminum Industry – REF. NO. EPA-R2-73-191
SO_2 Control Processes for Non-Ferrous Smelters – REF. NO. EPA-600/2-76-008

TITLE INDEX

Taxonomy of Klebsiella pneumoniae Isolated From Pulp/Paper Mill Wastewater – REF. NO. EPA-660/2-75-024
Technical Manual for Measurement of Fugitive Emissions: Upwind/Downwind Sampling Method for Industrial Emissions – REF. NO. EPA-600/2-76-089a
Technical Manual for Process Sampling Strategies for Organic Materials – REF. NO. EPA-600/2-76-122
Tertiary Treatment of Combined Domestic and Industrial Wastes – REF. NO. EPA-R2-73-236
Test Method for Volatile Component Stripping of Wastewater – REF. NO. EPA-660/2-74-044
Testing of a Molecular Sieve Used to Control Mercury Emission From A Chlor-Alkali Plant, Volume I – REF. NO. EPA-650/2-75-026a
Testing of a Molecular Sieve Used to Control Mercury Emission From A Chlor-Alkali Plant, Volume II – Appendices – REF. NO. EPA-650/2-75-026b
Ther V Solventless Metal Decorating for Three-Piece Cans— Background – REF. NO. EPA-600/2-76-011
Trace Pollutant Emissions from the Processing of Metallic Ores – REF. NO. EPA-650/2-74-115
Trace Pollutant Emissions from the Processing of Non-Metallic Ores – REF. NO. EPA-650/2-74-122
Treating Wood Preserving Plant Wastewater by Chemical and Biological Methods – REF. NO. EPA-600/2-76-231
Treatment and Disposal of Complex Industrial Wastes – REF. NO. EPA-600/2-76-123
Treatment and Recovery of Fluoride Industrial Waste – REF. NO. EPA-660/2-73-024
Treatment of Cheese Processing Wastewaters in Aerated Lagoons – REF. NO. EPA-660/2-74-012
Treatment of Citrus Processing Wastes – REF. NO. EPA-12060---10/70
Treatment of Domestic Wastewater and NSSC Pulp and Paper Mill Wastes – REF. NO. EPA-660/2-73-010
Treatment of Effluent Waters from Vegetable Oil Refining – REF. NO. EPA-600/2-76-294
Treatment of Elctroplating Wastes by Reverse Osmosis – REF. NO. EPA-600/2-76-261
Treatment of High Strength Meatpacking Plant Wastewater by Land Application – REF. NO. EPA-600/2-76-302
Treatment of Laundromat Wastes – REF. NO. EPA-R2-73-108
Treatment of Metal Finishing Wastes by Sulfide Precipitation – REF. NO. EPA-600/2-77-049
Treatment of Packing House Waste by Anaerobic Lagoons in Plastic-Media Filters – REF. NO. EPA-660/2-74-027
Treatment of Selected Internal Kraft Mill Wastes in a Cooling Tower – REF. NO. EPA-12040EEK08/71
Treatment of Sole Leather Vegetable Tannery Wastes – REF. NO. EPA-12120---09/70
Treatment of Sulfite Evaporator Condensates for Recovery of Volatile Components – REF. NO. EPA-660/2-73-030
Treatment of Wastewater from the Production of Polyhydric Organics – REF. NO. EPA-12020EEQ10/71
Trickling Filter Treatment of Fruit Processing Waste Waters – REF. NO. EPA-12060EAE09/71
Ultrathin Membranes for Treating Metal Finishing Effluents by Reverse Osmosis – REF. NO. EPA-12010DRH11/71
Use of Fungi Imperfecti in Waste Control – REF. NO. EPA-12060EHT07/70
Utilization of Bark Wastes – REF. NO. EPA-670/2-73-005
Vapor-Phase Organic Pollutants – Volatile Hydrocarbons and Oxidation Products – REF. NO. EPA-600/1-75-005
Vinyl Chloride – An Assessment of Emissions Control Techniques and Costs – REF. NO. EPA-650/2-74-097
Waste Citrus Activated Sludge As a Poultry Feed Ingredient – REF. NO. EPA-660/2-75-001
Waste Control and Abatement in the Processing of Sweet Potatoes – REF. NO. EPA-660/2-73-021
Waste Reduction in Food Canning Operations – REF. NO. EPA-12060---08/70
Waste Water Treatment and Reuse in a Metal Finishing Job Shop – REF. NO. EPA-670/2-74-042
Wastewater Abatement in Canning Vegetables by IQB Blanching – REF. NO. EPA-660/2-74-006
Wastewater Characterization for the Specialty Food Industry – REF. NO. EPA-660/2-74-075
Wastewater Treatment Facilities for a Polyvinyl Chloride Production Plant – REF. NO. EPA-12020DJI06/71
Wastewater Treatment Studies in Aggregate and Concrete Products – REF. NO. EPA-R2-73-003
Wastewater Use in the Production of Food and Fiber—Proceedings of a Conference Held at Oklahoma City, OK, March 5-7,1974 – REF. NO. EPA-660/2-74-041
Water and Waste Management in Poultry Processing – REF. NO. EPA-660/2-74-031
Water Pollution Control in the Primary Nonferrous Metals Industry, Vol. I – Copper, Zinc, and Lead Industries – REF. NO. EPA-R2-73-247a
Water Pollution Control in the Primary Nonferrous Metals Industry, Vol. II – Aluminum, Mercury, Gold, Silver, Molybdenum, and Tungsten – REF. NO. EPA-R2-73-247b
Water Reuse in a Paper Reprocessing Plant – REF. NO. EPA-600/2-76-232
Waterborne Wastes of the Paint and Inorganic Pigments Industries – REF. NO. EPA-670/2-74-030
Whey Effluent Packed Tower Trickling Filtration – REF. NO. EPA-12130DUJ09/71
Workshop on In-Plant Waste Reduction in the Meat Industry – REF. NO. EPA-600/2-76-214
Zinc Sludge Recycling After Kastone-R Treatment of Cyanide-Bearing Rinse Water – REF. NO. EPA-600/2-77-038

CURRENT PROJECTS ABSTRACTS SECTION

D281-0080a SIC 281 CHEMICALS CONTRACT NO. 68-02-1321

Source Assessment—Major Inorganic Manufacturing Industry Segments Pedco Environmental, Cincinnati, OH **PROJECT LIFE:** 03/75–12/77 **PROJECT COST:** $83,402 ($83,402)

Phase I—An indepth source assessment studying the qualitative and quantitative aspects of all pollutant emissions, as well as available technology and pollutant effects of major manufacturing industrial segments. This source assessment will provide the information necessary to determine the immediate impact of emissions. Phase II—A comprehensive study to assess and prioritize the multimedia pollution problems of the major inorganic manufacturing industrial segments. This study will prioritize the multimedia pollution problems to establish an emphasis for technology developments and demonstrations. EPA CONTACT: Mary Stinson

D281-0080b SIC 281 CHEMICALS CONTRACT NO. 68-02-1321

Source Assessment-Major Inorganic Manufacturing Industry Segments Dow Chemical Co. Midland, MI **PROJECT LIFE:** 03/75–12/77 **PROJECT COST:** $72,000 ($72,000)

Phase I—An indepth source assessment studying the qualitative and quantitative aspects of all pollutant emissions, as well as available technology and pollutant effects of major manufacturing industrial segments. This source assessment will provide the information necessary to determine the immediate impact of emissions. Phase II-A comprehensive study to assess and prioritize the multimedia pollution problems of the major inorganic manufacturing industrial segments. This study will prioritize the multimedia pollution problems to establish an emphasis for technology developments and demonstrations. EPA CONTACT: Mary Stinson

D281-0080c SIC 281 CHEMICALS CONTRACT NO. 68-02-2493

Source Assessment-Major Inorganic Manufacturing Industry Segments Versar, Inc. Springfield, VA **PROJECT LIFE:** 03/75–12/77 **PROJECT COST:** $97,000 ($97,000)

Phase I—An indepth source assessment studying the qualitative and quantitative aspects of all pollutant emissions, as well as available technology and pollutant effects of major manufacturing industrial segments. This source assessment will provide the information necessary to determine the immediate impact of emissions. Phase II-A comprehensive study to assess and prioritize the multimedia pollution problems of the major inorganic manufacturing industrial segments. This study will prioritize the multimedia pollution problems to establish an emphasis for technology developments and demonstrations. EPA CONTACT: Mary Stinson

D281-0406 SIC 281 CHEMICALS IAG NO. IAG-0189

Molecular Sieve Application to Nitric Acid Plant Department of the Army Picatinny Arsenal Dover, NJ **PROJECT LIFE:** 08/72–12/77 **PROJECT COST:** $331,000 ($80,384)

The project involves demonstration of molecular sieve technology to control NO_x emissions from the manufacture of nitric acid. Up to date, this technology gives the highest reduction of NO_x emissions, of 50 ppm of NO_x in the effluent gas stream, that can be achieved. However, this technology hasn't been adequately demonstrated. EPA CONTACT: Mary Stinson

D282-0128 SIC 282 CHEMICALS CONTRACT NO. 68-02-1874

Source Assessment—Plastics Processing Industry Monsanto Research Corporation Dayton, OH **PROJECT LIFE:** 04/75–03/77 **PROJECT COST:** $121,100 ($121,100)

The objective is to obtain data on the environmental impact of emissions from plastics processing operations. The approach is to evaluate plastics process operations, identify potentially toxic and hazardous materials emitted, develop and implement a comprehensive plan for sampling and analysis and evaluate the environmental impact of emissions from plastics operations. EPA CONTACT: Ronald Turner

D282-0130 SIC 282 CHEMICALS CONTRACT NO. 68-02-1874

Source Assessment—Chloroprene and Neoprene Manufacture Monsanto Research Corporation Dayton, OH **PROJECT LIFE:** 05/75–03/77 **PROJECT COST:** $90,000 ($90,000)

The objective is to assess the environmental impact of atmospheric emissions from polychloroprene manufacturing plants. The approach is to evaluate polychloroprene manufacturing processes, develop and implement a comprehensive plan for sampling and analysis and evaluate the environmental impact of emissions from polychloroprene manufacture. EPA CONTACT: Ronald Turner

CURRENT PROJECTS ABSTRACTS SECTION

D283-0158 SIC 282 CHEMICALS CONTRACT NO. 68-03-2341

Assessment of Best Available Technology Economically Achievable for Synthetic Rubber Manufacturing Wastewater Walden Research Division of Abcor 850 W. Main Street Wilmington, MA **PROJECT LIFE:** 08/75–11/77 **PROJECT COST:** $139,930 ($139,930)

A pilot plant investigation is envisioned to study the applicability of physical-chemical (P-C) treatment methods to synthetic rubber wastewaters. The use of P-C methods such as reverse osmosis, carbon adsorption, and ozonation will be explored as they can be applied to best practical treatment effluent as well as raw effluent from styrene butadiene rubber production. Appropriate pretreatment techniques for efficient P-C use will also be studied. The three primary manufacturing processes (emulsion, solution, and latex) used to produce synthetic rubber will provide a broad effluent range for the technological assessment. The study will quantitatively and qualitatively concern itself with environmental and economic factors as well as the energy aspects of treatment. EPA CONTACT: David L. Becker

D283-0141 SIC 282 CHEMICALS GRANT NO. 804693

Demonstration of In-Plant Recovery of Reusable Materials from PVC Manufacturing Wastes Hafner Industries New Haven, CT **PROJECT LIFE:** 09/76–01/78 **PROJECT COST:** $590,000 ($85,000)

Pilot demonstration of techniques to recover reusable materials such as chemicals, finished products, and raw materials from polyvinyl chloride manufacturing wastes. This provides an incentive to pollution control by reducing waste products, saving energy and providing a saleable product. EPA CONTACT: Mark Stutsman

D282-0448 SIC 282 CHEMICALS CONTRACT NO. 68-02-1874

Source Assessment—Polyvinyl Chloride Industry Monsanto Research Corporation Dayton, OH **PROJECT LIFE:** 05/75–03/77 **PROJECT COST:** $77,200 ($77,200)

The objective of this contract is to assess the environmental impact of atmospheric emissions from polyvinyl chloride manufacturing plants. The approach includes an evaluation of PVC manufacturing plants, development and implementation of a comprehensive plan for sampling and analysis, and evaluation of the environmental impact of emissions from PVC manufacturing plants. EPA CONTACT: Ronald Turner

D283-0040 SIC 283 CHEMICALS GRANT NO. 803306

Demonstration of Evaporator-Incinerator for Concentrated Pharmaceutical Wastes Pfizer Pharmaceuticals, Inc. P.O. Box 628 Barceloneta, Puerto Rico **PROJECT LIFE:** 07/74–10/77 **PROJECT COST:** $231,000 ($119,000)

A treatment facility for control of wastewaters from batch manufacturing operations relatively high in organics and dissolved salts has been constructed and is being operated. The process sequence selected includes evaporation and incineration of organics, thermal degradation of weak acid salts, and crystallization and fluid bed drying of ionic salts. Waste heat will be recovered and reused within the system. Products should be water vapor, dry salts, and aqueous sodium carbonate from scrubbers. In addition, the presence or possible presence of a wide range of pollutants identified as toxic (65) will be assessed. For those believed to be present, the effectiveness of this destructive control technology will be evaluated and quantified using available analytical methods. EPA CONTACT: Herbert S. Skovronek

D283-0135 SIC 283 CHEMICALS GRANT NO. 804428

An Evaluation of the Anaerobic Filter as a Device for Treating Pharmaceutical Wastes Syracuse University Civil Engineering Department Syracuse, NY **PROJECT LIFE:** 05/76–05/78 **PROJECT COST:** $53,000 ($50,000)

The proposed work envisions determining the effectiveness of anaerobic filtration for concentrated pharmaceutical wastes. A bench pilot trickle bed will allow the development of design equations for scale up and provide a broader data bank for the application of anaerobic systems. Anaerobic systems appear to be the best alternative for treatment due to their amenability to concentrated wastes. A further aspect of the study will be the investigation of the occurrence of toxic materials. A qualitative and quantitative assessment of occurrence in manufacturing and control using the technology under investigation will be undertaken. EPA CONTACT: Herbert S. Skovronek

CURRENT PROJECTS ABSTRACTS SECTION

D284-0039 6 **SIC 284 CHEMICALS** **GRANT NO. 803892**

Performance of Rotating Biological Contactor on Liquid Detergent Plant Effluent Texize Chemicals Company P.O. Box 368 Greenville, SC **PROJECT LIFE:** 06/76–01/78 **PROJECT COST:** $82,000 ($56,000)

The objective of the project is to determine the efficiency of the rotating biological contractor (RBC) system in treating effluent from a liquid detergent manufacturing plant. Efficiency will be compared to an extended aeration system now in operation and advantages and disadvantages of the experimental system identified. A pilot unit will be operated with the same feed as the existing plant and performance under various conditions will be determined. Variables to be evaluated include performance at optimum conditions compared to extended aeration, maximum loadings at wastewater temperatures experienced both during the summer and winter. The project will also investigate the occurrence of toxic materials. A qualitative and quantitative assessment of occurrence and control using existing methods and those under investigation, will be undertaken. EPA CONTACT: Ronald Turner

D284-0050 **SIC 284 CHEMICALS** **GRANT NO. 804367**

Demonstration of Ultrafiltration and Carbon Treatment of Industrial Laundering Wastewaters Institute of Industrial Launderers 1730 M Street, NW, Suite 613 Washington, DC **PROJECT LIFE:** 12/75–05/77 **PROJECT COST:** $136,837 ($130,000)

The objective is to demonstrate economically acceptable technology which can treat industrial laundering effluents and produce water of a quality for reuse within the laundry. The treatment process is based on ultrafiltration with pretreatment to remove gross suspended solids and post treatment to remove contaminants which pass through ultrafiltration membranes. EPA CONTACT: Ronald Turner

D286-0129 **SIC 286 CHEMICALS** **CONTRACT NO. 68-02-1319**

Assessment of Typical Plant Configurations in the Organic Chemicals Industry Radian Corporation 8500 Shoal Creek Boulevard P.O. Box 9948 Austin, TX **PROJECT LIFE:** 01/76–07/76 **PROJECT COST:** $56,000 ($56,000)

The purpose of this work is to determine similarities between organic chemicals manufacturing facilities in the United States. This is needed so as to enable the Agency to establish common bases for writing regulations and emission and effluent limitations. The study utilizes data on the major organic chemicals manufacturing plants which was gathered and computerized as part of project 1.7-04A-02. A data base of over 400 industrial organic chemicals used in commerce has been gathered and a data retrieval program is being developed to facilitate rapid retrieval of this data. Data being gathered and computerized include: identification and location of chemical plants, product slate for each plant, industrial compounds involved in each process, toxicity data for each compound, and production volumes. EPA CONTACT: David L. Becker

D286-0132 **SIC 286 CHEMICALS** **CONTRACT NO. 68-02-1323**

Source Assessment—Industrial Organic Chemicals and Dyes Industries and Organic Pigments Battelle Columbus Laboratories 505 King Avenue Columbus, OH **PROJECT LIFE:** 03/76–08/76 **PROJECT COST:** $70,040 ($70,040)

This study will identify the potential hazards associated with the production and utilization of industrial organic chemicals and organic pigments and dyes. Rather than a detailed study of the industries, this is a first step, a review of the secondary literature which will result in a framework that further, more detailed, work will fill out. This "framework" will also show the areas that need further research. The main product will be a set of tables listing the chemical compounds associated with these industries, the processes they are used in, their toxicities (available data), pollution abatement equipment used to control them and other pertinent information. EPA CONTACT: Leo Weitzman

D286-0137 **SIC 286 CHEMICALS** **GRANT NO. 804455**

Modified Wet Scrubbing of Immiscibles Emitted from the Manufacture and Processing of Organic Products New Jersey Institute of Technology 323 High Street Newark, NJ **PROJECT LIFE:** 05/76–04/78 **PROJECT COST:** $87,243 ($55,000)

The proposed investigation is to examine a series of organic compounds and their removal from gas streams by use of aqueous scrubbing solutions. Water scrubbing of air streams containing organic vapors in concentration ranges of 0.01 lb/mft3 to 1 lb/mft3 is at present impractical. Organic compounds with relatively high vapor pressures or poor solubility in water are not easily absorbed in conventional wet scrubbing processes. Solubility is a function of the physical properties of the solutesolvent interface. It is proposed to study changing solubility, wetting, surface tension and viscosity properties and effects on mass transfer between selected organic vapors and water. To change these properties a study of the effects of various surface active agents will be undertaken. Laboratory simulation of mass transfer conditions is to be effected as a screening mechanism for these systems showing the greatest promise. A packed tower with suitable packing, piping, control devices will be used to determine operability of organic-vapor-aqueous system on a semi-commercial scale. EPA CONTACT: Leo Weitzman

CURRENT PROJECTS ABSTRACTS SECTION

D286–0140 SIC 286 CHEMICALS GRANT NO. 800802

Investigation of Treatment Technologies for Dye Manufacture Wastewaters Clemson University Clemson, SC **PROJECT LIFE:** 10/76–12/78 **PROJECT COST:** $36,500 ($35,000)

The proposed study will investigate treatment technologies for a typical dye wastewater. Wet oxidation and ozonation will be investigated as pretreatment steps for rendering refractory dye waste constituents amenable to subsequent treatment by biological, activated carbon, and combined biological-activated carbon systems. Optimum design criteria will be developed for each of the pretreatment steps and for each of the subsequent treatment systems. Analyses will be made for selected toxic compounds across each of the pretreatment steps and across each of the treatment systems to determine the removal of toxic substances and to investigate the possibility of producing toxic substances in each unit process. EPA CONTACT: Leo Weitzman

D286–0430 SIC 286 CHEMICALS CONTRACT NO. 68–02–1874

Source Assessment—Organic Waste Solvent Reclaiming Monsanto Research Corporation Dayton, OH **PROJECT LIFE:** 07/76–09/77 **PROJECT COST:** $50,000 ($50,000)

The objective is to identify the impact on the environment from atmospheric emissions from solvent reclaiming operations. The approach is to identify the companies involved in waste solvent reclaiming, assess the existing pollution control technology, identify hazardous and potentially hazardous materials emitted, produced or used and identify areas where new or improved technology is required. EPA CONTACT: Ronald Turner

D289–0038 SIC 289 CHEMICALS GRANT NO. 803702

Durability of Heterogeneous, Aqueous Phase Oxidation Catalysts for Industrial Wastewater Treatment University of Delaware Department of Chemical Engineering Newark, DE **PROJECT LIFE:** 07/75–05/77 **PROJECT COST:** $29,997 ($26,045)

This project will demonstrate, in laboratory scale, the practical applicability of aqueous phase catalytic oxidation for removal of organics in industrial wastewater streams. Candidate waste streams include reverse osmosis concentrate from dye waste treatment, adhesives and sealants waste UF concentrate, and a composite explosive waste (pink water). Catalyst durability and resistance to poisoning will be evaluated under operating conditions. The major catalyst poisons and the range of optimum catalyst activity will be determined. Economics of treatment will be determined. EPA CONTACT: Leo Weitzman

D289–0041 SIC 289 CHEMICALS IAG NO. IAG–D5–0753

The Application of Ultrafiltration Methods for the Removal of Nitrocellulose Fines from Munitions Plant Wastewaters U.S. Army Natick Development Center Natick, MA **PROJECT LIFE:** 10/75–05/78 **PROJECT COST:** $108,000 ($64,000)

The proposed project envisions an investigation utilizing ultrafiltration for the removal of nitrocellulose fines from a munitions manufacturer's waste stream. The investigation will concern itself with the monitoring and analysis of a pilot plant facility located at the Radford Plant. Beyond quantification of parameters such as suspended solids, nitrocellulose, dissolved solids, pH, COD, BOD, and the presence of heavy metals the system will identify the optimum inlet, outlet pressure requirements, maximum flux, solids rejections and membrane configuration. Overall reliability of the system, maintenance, power requirements, downtime for cleaning will also be evaluated. Preliminary results have indicated the ultrafiltration method to provide excellent removals. The project will also investigate the occurrence of toxic nitrobodies. A qualitative and quantitative assessment of occurrence and control using existing methods and those under investigation will be undertaken. EPA CONTACT: Herbert S. Skovronek

D289–0047 SIC 289 CHEMICALS CONTRACT NO. 68–03–1323

Preliminary Assessment of Compounding and Fabricating Industries Battelle 505 King Avenue Columbus, OH **PROJECT LIFE:** 03/76–10/76 **PROJECT COST:** $56,700 ($56,700)

The objective is to identify those industries which are concerned with compounding and fabricating and to identify the companies, products and processes associated with each industry, and to identify the environmental impact resulting from the processing steps used in those industries. The approach is to examine appropriate SIC category, company-product relationship, environment, and to identify further investigation needs. EPA CONTACT: Ronald Turner

CURRENT PROJECTS ABSTRACTS SECTION

D289-0049 **SIC 289 CHEMICALS** **GRANT NO. 803686**

Truck Washing Terminal Water Pollution Control Matlack Inc. 10 W. Baltimore Avenue Landsdowne, PA **PROJECT LIFE:** 06/75–11/77 **PROJECT COST:** $398,000 ($190,000)

This project will demonstrate in full-scale a physical/chemical/ biological treatment process for the treatment of wastewaters generated during the internal washing of tank trucks. The economics and effectiveness of each of the unit processes to be utilized, i.e. sedimentation, air flotation, filtration, carbon adsorption, and biological treatment, will be determined. The feasibility of reusing the treated wastewater and reclaiming the oily fractions as fuel will also be studied. The project will also investigate the occurrence of toxic materials. A qualitative and quantitative assessment of occurrence from tank truck cleanings and control using the technology under investigation will be undertaken. EPA CONTACT: Ronald Turner

D289-0051 **SIC 289 CHEMICALS** **IAG NO. IAG-D5-0059**

Comparison of Oxidative Processes for Nitrobodies (TNT Pink Water) Treatment U.S. Department of the Army Picatinny Arsenal Dover, NJ **PROJECT LIFE:** 07/76–05/77 **PROJECT COST:** $236,000 ($60,000)

Using both in-house facilities and staff and sub-contractors offering specific oxidative technology, the Arsenal will evaluate alternate means of destructively eliminating nitro-aromatic species from wastewaters. Although TNT-derived pink water will be used, it is expected that the technology will also be applicable to other hazardous or toxic nitrobodies. Based on the results of the feasibility study the Arsenal staff will then evaluate the most promising technology in a pilot scale unit. EPA CONTACT: Herben S. Skovronek

D289-0134 **SIC 289 CHEMICALS** **GRANT NO. 804401**

State of the Art of Demilitarization of Explosives and Propellants American Defense Preparedness Association Washington, DC **PROJECT LIFE:** 04/76–08/77 **PROJECT COST:** $31,600 ($30,000)

The grantee will survey available documentation in the hands of the military and visit various demilitarization facilities and the associated pollution control facilities. The purpose of this data collection process will be to (1) assess the extent of air, water, and residue pollution problems created by such operations, (2) determine the current status of waste discharge control in this industry, and (3) identify areas where additional R,D,&D may be necessary to assure acceptable aqueous, air or residue discharges from such facilities. EPA CONTACT: Herbert S. Skovronek

D289-0139 **SIC 289 CHEMICALS** **GRANT NO. 804350**

Treatment of Wastewaters from Adhesives and Sealant Manufacture by Ultrafiltration Dewey and Almy Chemical Division 55 Hayden Avenue Lexington, MA **PROJECT LIFE:** 05/75–08/77 **PROJECT COST:** $125,500 ($94,125)

The objective of this project is to establish the effectiveness of ultrafiltration, reverse osmosis and carbon treatment for wastewaters from the manufacture of adhesives and sealants. Ultrafiltration will be studied under actual plant conditions. R.O. and carbon adsorption will be studied under bench scale conditions. The proposed work will establish, on an overall basis, cost effectiveness for system use, in-plant water reuse and applicability to other manufacturing segments. EPA CONTACT: Ronald Turner

G200-0004 **SIC 200 FOOD PRODUCTS** **GRANT NO. 804642**

Preliminary Multimedia Assessment of Pollution Problems in the Food Industry Stanford Research Institute Menlo Park, CA **PROJECT LIFE:** 07/76–01/78 **PROJECT COST:** $134,814 ($128,076)

The objectives of this study are to identify the research, development, and demonstration needs for prevention and control of air, land, and water pollution from the food industry and to discuss methods of setting program priorities. This study will emphasize the environmental significance of the processes and specific unit operations employed in the food industries. The scope of work as envisioned at this time includes four tasks: (1) development of industries profile—identify companies, products, and processes. (2) identification and characterization of emission streams— quantify solid waste, water, and air emissions by product and by unit processing operation, (3) discussion of control technology needs—discuss adequacy of existing technology from both a technical and economic standpoint and identify RD&D needs, (4) discussion of program priorities—suggest criteria for setting priorities and quantify the analysis where possible to aid in setting priorities. EPA CONTACT: Kenneth A. Dostal

CURRENT PROJECTS ABSTRACTS SECTION

G201-0086 SIC 201 FOOD PRODUCTS GRANT NO. 12060 EUB

Construction and Study of a Demonstration Plant Utilizing the Aerobic Channel Method for Treating Packinghouse Wastes John Morrell and Company Ottumwa, IA **PROJECT LIFE:** 12/66–12/76 **PROJECT COST:** $815,000 ($489,000)

Four oxidation channels will be constructed to handle an equivalent load of 20,000 lbs of BOD/day from a packinghouse on a 7-day basis with estimated flow of 3.5 mgd. The objective is to find an efficient, effective, and economical method of treating raw packinghouse wastes so they can be discharged directly into streams. Each channel will be 460 ft. x 60 ft. with a capacity of 150,000 cu. ft. Channels 1 and 2 will receive raw wastewater from existing primary treatment systems. The overflow will be directed into Channels 3 and 4 which will be operated intermittently as aerator and settling basins. Channel 4 will allow the sludge to be returned to Channels 1 and 2 or removed for harvesting. The solids removed will be centrifuged or evaporated and dried. The most feasible way of handling solids will be determined. Tests will be conducted to determine if the dried solids can be used as an animal-food supplement. The process will be designed to give variable rates of aeration and flow to obtain maximum biochemical oxygen demand and nitrogen removal. The flow will be tested for total volatile solids, total fixed solids, phosphate, total bacterial content, and coliform count. EPA CONTACT: Jack L. Witherow

G201-0087 SIC 201 FOOD PRODUCTS GRANT NO. 12060 GPP

Small Meatpacker Waste Treatment Systems W. E. Reeves Packinghouse P.O. Box 477 Ada, OK **PROJECT LIFE:** 11/70–01/77 **PROJECT COST:** $51,185 ($35,829)

The objectives of this project are to evaluate various biological systems for the treatment of small meat packing house waste flows. The specific objectives will include: (1) demonstration to small meatpackers of the suitability of the anaerobic-aerobic lagoon system with high BOD removal, simplicity of operation, and minimum capital and maintenance costs; (2) evaluation of the need for sludge recirculation in anaerobic lagoon and for aeration and sludge retention in the first-stage aerobic lagoon; (3) determination of the economic and technical advantages of an aerated-aerobic lagoon system versus the anaerobic-aerobic lagoon system; (4) demonstration to the meatpacking industry of the capability of the spray-runoff soil treatment system to meet future requirements for nitrogen and phosphorus removal in addition to high BOD reduction using the raw effluent. The project data and evaluations of the waste treatment systems will provide the basis for the development of a manual for small meatpacking house wastewater treatment. EPA CONTACT: Jack L. Witherow

G201-0090 SIC 201 FOOD PRODUCTS GRANT NO. 803766

Intermittent Sand Filters as a Treatment System for Small Meat Packers East Central Oklahoma State University Ada, OK **PROJECT LIFE:** 06/75–06/77 **PROJECT COST:** $61,407 ($55,455)

The objectives of this project are: 1. To demonstrate the use of intermittent sand filters as a means of upgrading treatment systems for small meat packers to meet 1984 NPDES guidelines, 2. To develop a simple and economically feasible technique for monitoring the treated waste from small meat packing plants which could meet the NPDES monitoring program, 3. To provide the small meat packers with information related to the construction, operation, and maintenance of intermittent sand filters. EPA CONTACT: Jack L. Witherow

G201-0103 SIC 201 FOOD PRODUCTS GRANT NO. 802833

Characterization and In-Plant Reduction of Wastewater from Hog Slaughtering Operations University of Wisconsin-Madison Madison, WI **PROJECT LIFE:** 03/74–02/77 **PROJECT COST:** $111,962 ($76,106)

The proposed study involved in-plant studies to identify and evaluate wastewater components emanating from critical units in hog slaughtering and associated cleaning operations. Based on the results of waste characterization studies methods are to be developed for reducing the quantity and improving the quality of the wastewater load discharged within the constraints imposed by the need for maintaining high quality meat products and byproducts. Specific studies will be designed and conducted on critical units in hog slaughtering operations, namely, 1. removal and recovery of blood; 2. removal, processing and disposal of hair; 3. processing of the hog carcass; 4. processing of the intestinal tract. Plant investigations will consist of a. selecting the most representative test sites for each of the four processes; b. developing sampling procedures and analytical methods for characterization of specific waste streams; c. monitoring current and modified unit processes to determine and demonstrate their effectiveness in reducing waste loads. Laboratory and statistical analyses supportive of the in-plant investigations will be conducted. Data will be analyzed to assess the performance of each unit process. Results will be correlated for practical application in the numerous hog slaughtering plants (450) located throughout the nation. EPA CONTACT: Jack L. Witherow

CURRENT PROJECTS ABSTRACTS SECTION

G201-0104 SIC 201 FOOD PRODUCTS GRANT NO. 803325

Poultry Processing Wastewater Reuse—Effects on Product and Water Safety Maryland State Department of Health and Mental Hygiene 610 North Howard Street Baltimore, MD **PROJECT LIFE:** 07/74–07/77 **PROJECT COST:** $128,900 ($79,900)

This project is to evaluate the safety for human consumption of poultry processed in a plant utilizing reclaimed wastewater in a closed loop water system. The poultry plant will reuse about 50% of their own processing wastewater which comes from highly regulated operations. Safety will be determined on the relative amounts of contaminants with utilization of the present well water source versus utilization of the reclaimed wastewater. A full scale wastewater reclamation system has been constructed at the Sterling Processing Co. in Oakland, MD. The purpose of the project is to demonstrate the technical and economic feasibility of the national goal of no discharge of pollutants into navigable waters via a closed loop water system in the food industry. The food processing industry, one of the five major water using industries, will for economic reasons go to: first – land disposal, second – water reuse, and third – discharge to navigable waters if a no-discharge-of-pollutants limitation is imposed. Most plants will not have the land disposal option available because of location, thus water reuse is the economically viable alternative to obtain the national goal. Therefore demonstrating the 1985 national goal of no discharge of pollutants by the food processing industry can be accomplished by establishing the safety of reuse of the reclaimed wastewater. EPA CONTACT: Jack L. Witherow

G201-0105 SIC 201 FOOD PRODUCTS GRANT NO. 803614

Processing of Poultry By-Products for the Elimination of Pollutants University of Missouri Columbia, MO **PROJECT LIFE:** 03/75–02/78 **PROJECT COST:** $42,808 ($16,483)

Demonstrate the feasibility and economics of reducing the waste load by dehydrating and reusing egg breaking wastes as feedstuffs from an egg processing facility, a commercial chick hatchery, and a broiler chick hatchery. The chemical composition of the dried products will be determined. Undehydrated wastes will be analyzed for their pollution potential. EPA CONTACT: Jack L. Witherow

G201-0106 SIC 201 FOOD PRODUCTS GRANT NO. 800930

Recycling of Water in Poultry Processing Plants Pacific Egg and Poultry Association 5420 Jefferson Boulevard Los Angeles, CA **PROJECT LIFE:** 06/72–09/76 **PROJECT COST:** $150,550 ($99,206)

The primary objective of this project is to conduct pilot scale studies to recycle chiller wastewater at a rate of 500 gallons per minute following filtration and sterilization steps. The recycling system consists of a traveling screen to remove coarse solids, a cyclonic desludger for solids removal of particle sizes 100 Mu or larger, and an ultraviolet unit for sterilization. The letters irradiation will impart a minimum dosage of 30,000 micro watts/sq. cm. to the chiller water stream, well above the minimum to eliminate a major portion of viable pathogens and viruses. An analysis of BOD, total solids, oil and grease, iron, chlorides, total plate count, coliform count, salmonella incidence, poultry virus incidence, temperature and adsorption at 253.7 nm, will be conducted at appropriate time intervals and locations in the continuous chiller system. The principal site of the study will be at Foster Farms Inc., located in Livingston, California. This plant processes 180,000 birds per day in a two-shift, 15 hour operation. EPA CONTACT: Vern Tenney

G201-0114 SIC 201 FOOD PRODUCTS GRANT NO. 804296

Safety Evaluation of Renovated Wastewater University of Pittsburgh Graduate School of Public Health Pittsburgh, PA **PROJECT LIFE:** 10/75–06/77 **PROJECT COST:** $116,000 ($56,000)

The objective of this project is to evaluate the safety for human consumption of poultry slaughtered and processed with an average 50% mixture of treated well-water and reclaimed wastewater from the same plant. The wastewater reclamation system has been constructed. The purpose of this project is to evaluate with actual recycle the safety of the renovated water and the processed poultry, in terms of any chemical and microbiological contaminants likely to be present and have an adverse effect on human health. After the renovation system has been optimized (Phase 1), a two-month study (Phase 2) will be instituted, without actual return of water to the treatment plant, following which an evaluation will be made with representatives of the Department of Agriculture and the EPA as to the quality of the renovated water and the contaminants in the carcasses processed with well water and renovated water. If the evaluation indicates that there is no danger to human health, Phase 3 will be instituted in which for a three month period there will be recycling of the renovated water through the processing plant; such water will not be used for potable purposes. The water and processed poultry will be studied as in Phase 2. Following the termination of Phase 3, an evaluation will be made of the health implications of continuing processing the poultry with the mixture of treated wastewater and well-water, as well as the need for monitoring to insure the safety of the system and the protection of human health. The object of the project is not to prove that potable water can be produced from reclaimed wastewater, only that a water satisfactory for processing poultry can be produced. EPA CONTACT: Herb Pahren

CURRENT PROJECTS ABSTRACTS SECTION

G201-0474 SIC 201 FOOD PRODUCTS GRANT NO. EPA/SFCP P

Water Renovation and Reuse in Poultry Processing Higher Institute of Public Health 165 El Horria Avenue Alexandria, Egypt **PROJECT LIFE:** 04/76–04/80 **PROJECT COST:** $216,000 ($216,000)

Objectives of this project include: 1. Characterize the chemical, physical and biological natures of unit effluents of Alexandria Poultry Processing Plant, 2. Study feasibility of treating and reusing effluents using centrifugation, carbon absorption and air flotation, 3. Reduce water requirements, 4. Examine impact of water recycling and reuse on shelf life, hygienic quality and nutritional value, 5. Economic evaluation. Special attention will be paid to the effluents of the scalding tank, feather flume and body washes. EPA CONTACT: Jack L. Witherow

G201-0576 SIC 201 FOOD PRODUCTS GRANT NO. 804677

Lagoon, Spray Runoff Irrigation and Chemical Treatment of Slaughterhouse Wastewater in Cold Climates University of Notre Dame Civil Engineering Building Notre Dame, IN **PROJECT LIFE:** 11/76–07/78 **PROJECT COST:** $112,237 ($101,400)

This project is to demonstrate the technical and economic feasibility of meeting "Best Available Treatment Economically Achievable" guidelines for small slaughtering/packing plants in cold climates utilizing inexpensive, and simply operated, land intensive treatment processes. EPA CONTACT: Jack L. Witherow

G202-0085 SIC 202 FOOD PRODUCTS GRANT NO. 803374

Dairy Feed Plant Waste Control The Kroger Company 1014 Vine Street Cincinnati, OH **PROJECT LIFE:** 08/75–01/79 **PROJECT COST:** $379,400 ($167,300)

The overall objective of this investigation is to develop management and engineering program to reduce fluid wastes in dairy plants toward the 1985 goal of PL-92–500 of zero industrial waste discharge. A modern dairy plant producing fluid milk products, frozen desserts and cottage cheese located in Indianapolis, Indiana will be chosen as a typical modern dairy plant. Following a complete plant survey of current waste loads and sources, programs will be developed, evaluated and optimized to provide in-plant control to effect an overall reduction in waste loads of about 90%. First an effective management control program will be initiated, followed by engineering modifications of current systems and finally the introduction of new advanced technology to attempt to completely reduce fluid wastes to a zero level. EPA CONTACT: Larry Dempsey

G202-0098 SIC 202 FOOD PRODUCTS GRANT NO. 803301

Utilization of Cheese Whey for Wine Production Oregon State University Department of Food Science and Technology Corvallis, OR **PROJECT LIFE:** 06/74–03/77 **PROJECT COST:** $38,995 ($37,045)

The objective of this project is to demonstrate the technical feasibility of producing acceptable alcoholic beverages from the vast quantity of cheese whey that currently requires disposal. Our approach is to utilize the entire whey, under controlled fermentation conditions, without having to remove the water portion of the whey, thereby eliminating the necessity of disposing the large volume of liquid. Another aspect is the utilization of the whey without requiring energy resources. Preliminary investigations indicate that there is a good potential for producing acceptable alcoholic beverages from cheese whey. EPA CONTACT: Kenneth A. Dostal

G202-0101 SIC 202 FOOD PRODUCTS GRANT NO. 800747

The Construction Operation of a Demonstration Plant for the Commercial Production of Protein by the Fermentation of Acid and/or Sweet Whey Amber Laboratories Division Milbrew, Inc. 330 S. Mill Street Juneau, WI **PROJECT LIFE:** 07/73–12/76 **PROJECT COST:** $4,193,950 ($170,000)

From the successful operation of a demonstration pilot plant over extended periods of time (EPA Project S-800747) it has been shown that yeast may be grown on acid or sweet whey in a continuous, deep tank, aerated, agitated fermentor. By a process of evaporation and drying of the whole fermented whey mass, and the utilization of the evaporator condensate to dilute incoming condensed whey, a high protein, non-toxic feed material may be produced without any effluent streams. We propose that this project be continued to construct and operate a demonstration plant. The proposed plant would have a capacity of producing 4,500 tons of high grade protein feed material annually which represents the utilization of the equivalent of 200 million pounds of raw whey. Amber Laboratories would construct such plant and is asking for support for the direct operating costs for one year. The successful operation of this commercial size facility would demonstrate how tremendous amounts of a potential pollutant may be upgraded and transformed into a useful and needed material. EPA CONTACT: Larry Dempsey

CURRENT PROJECTS ABSTRACTS SECTION

G202–0102 **SIC 202 FOOD PRODUCTS** **GRANT NO. 12060 DXF**

Development and Demonstration of an Ultrafiltration Plant for the Abatement of Pollution from Cottage Cheese Whey Crowley's Milk Company, Inc. 145 Conklin Avenue Binghamton, NY **PROJECT LIFE:** 09/69–11/76 **PROJECT COST:** $914,081 ($495,856)

A two-stage ultrafiltration system for the separation and concentration of protein and lactose or straight acid whey concentration with a resulting influent BOD reduction of 99 percent will be demonstrated. Phase I, lasting 13 months, calls for the design, detailed engineering, construction, operation and evaluation in Binghamton, New York of a 10,000 lb/day UF system and will include the design of a 250,000 lb/day system for full-scale demonstration under Phase II. Duration of Phase II will be 17 months. EPA CONTACT: Larry Dempsey

G202–0121 **SIC 202 FOOD PRODUCTS** **GRANT NO. 803863**

A Demonstration Project—Utilization of Cheese Whey for Wine Production Foremost-McKesson, Inc. 6363 Clark Avenue Dublin, CA **PROJECT LIFE:** 10/75–06/78 **PROJECT COST:** $113,631 ($85,093)

The overall objective of the whey wine project is to demonstrate the commercial feasibility of making wine from whey. To achieve this objective, Foremost will utilize a multi-functional approach to determine the economic feasibility, production feasibility and consumer acceptance of whey wine. The output of this project should be a comprehensive analysis which can be presented to both large and small companies to encourage greater commercial utilization of whey. Subsequent projects have indicated the feasibility of producing acceptable alcoholic beverages from cheese whey. EPA CONTACT: Kenneth A. Dostal

G203–0093 **SIC 203 FOOD PRODUCTS** **GRANT NO. 802280**

Reuse of Treated Fruit Processing Wastewater Within a Cannery Snokist Growers Cannery Division 2506 Terrace Heights Road Yakima, WA **PROJECT LIFE:** 07/74–01/78 **PROJECT COST:** $381,100 ($249,500)

This project is to evaluate the feasibility of reusing treated process wastewater as a raw process water supply. Spent fruit canning process water will be evaluated for reuse after passage through the treatment sequence of screening, biological treatment (activated sludge), chemical coagulation, dual media filtration, and chlorination. Food safety and quality, and plant sanitation will be the primary basis for determining feasibility of reusing the reclaimed process water. Throughout this study the reclaimed water will be used on a continuous basis for gutter wash. This provides the opportunity to monitor the quality and dependability of the reclaimed water without affecting food safety. However, during each commercial processing season other uses of the water will be evaluated based on the results obtained from short duration runs using commercial processing equipment. Specific study objectives are: 1. Determine the feasibility of fruit processing wastewater treatment to achieve a suitable water quality for reuse; and to develop operational procedures to insure consistent performance of the treatment facility. 2. Determine the feasibility of reusing the treated fruit processing wastewater for: equipment cleaning; product cleaning and conveying; boiler feed to produce steam for cleaning, exhausting, cooking, blanching; and direct contact container cooling. 3. Document the reduction of pollutants being discharged to the environment resulting from reuse of treated processing wastewater; and evaluate the economics of wastewater reuse for achieving EPA's 1983 effluent standards. EPA CONTACT: Harold W. Thompson

G203–0094 **SIC 203 FOOD PRODUCTS** **IAG NO. EPA-IAG-D5–0795**

Commercial Feasibility of Recovering Tomato Processing Residues for Feed Use USDA, ARS Western Regional Research Center Berkeley, CA **PROJECT LIFE:** 05/75–10/77 **PROJECT COST:** $323,400 ($200,000)

Wet-caustic peeling of tomatoes results in the loss of food and creates a high strength liquid effluent. By altering the peeling process and subsequent operations, it is possible to increase the amount of recovered food material and simultaneously reduce the quantity of organic pollutants which are normally discharged. This study will evaluate methods to reduce the peel losses due to the wet-caustic peeling of tomatoes. Mechanical peel removal with rubber discs reduces water usage to such an extent that the alkaline peel residue (approx. 6% T.S.) can be physically separated into concentrated pulp and skin fractions. The alkaline pulp fraction can then be neutralized in a variety of ways, either directly with acid, or by combining with an acid-treated macerate or pomace. This recovered pulp can then be combined with tomato pulp from the regular plant operations and used in sauces, catsup, etc. Trials will be conducted in canneries to evaluate the commercial feasibility of recovering food-grade materials at commercial flow rates and practical conditions. EPA CONTACT: Harold W. Thompson

CURRENT PROJECTS ABSTRACTS SECTION

G203–0109 SIC 203 FOOD PRODUCTS GRANT NO. 803712

Low Wastewater Potato Starch-Protein Production Process University of Massachusetts Department of Food and Agricultural Engineering Amherst, MA **PROJECT LIFE:** 07/75–03/77 **PROJECT COST:** $195,400 ($80,400)

Under this project a process for producing starch, feed grade protein meal, and pulp from cull potatoes with minimal water use (25 pounds per 100 pounds of input potatoes) has been developed and is currently being "tuned." Potatoes are ground and wet sieved to remove pulp. Recycled juice is used in the sieving process to flush starch from the pulp. The pulp, after pressing or centrifuging to remove residual juice, is dried. The starch-juice mixture is passed through an elutriation type liquid cyclone yielding a starch-rich underflow and a starch-free juice overflow. The use of lowvolume elutriation in the cyclone minimizes protein and fiber in the starch underflow which is dewatered and washed in a basket centrifuge, dried and ground. A bleed stream from the recycled juice removes the protein introduced by the potatoes. This juice, which contains 4% solids (w.b.) and 50% protein (d.g.), is concentrated and dried. The use of ultrafiltration, or heat and acid induced precipitation, to concentrate and fractionate juice solids is currently being investigated. Upon completion of the developmental work optimization or process parameters will be performed via pilot scale production runs. These runs will allow mass and energy balances, and an economic analysis to be conducted on the evolved production process. EPA CONTACT: Harold W. Thompson

G203–0111 SIC 203 FOOD PRODUCTS GRANT NO. 803312

Integrated IQB Vibratory Blanch Cooler for Reducing Pollution Caused by Blanching of Vegetables American Frozen Food Institute 919 18th Street, N.W. WA, DC **PROJECT LIFE:** 07/74–01/78 **PROJECT COST:** $147,700 ($110,600)

This study will evaluate a prototype scale low effluent blanchercooling system on lima and green beans, brussel sprouts, cauliflower, and broccoli. In this system the steam condensate from the blancher (Individual Quick Blanch) is utilized for spray cooling the product prior to freezing. Significant reduction in liquid effluent volume (90%), and in the organics (70%) contained therein should be demonstrated when compared to current industrial practices. EPA CONTACT: Harold W. Thompson

G203–0112 SIC 203 FOOD PRODUCTS GRANT NO. 803251

Tomato Cleaning and Water Recycle National Canners Association 1133 20th Street, N.W. Washington, DC **PROJECT LIFE:** 06/74–01/78 **PROJECT COST:** $365,00 ($271,100)

The objectives of this project are to: 1. Demonstrate on commercial scale the reduction in the quantity of water required to clean tomatoes by the use of a flexible spinning rubber disc cleaner. 2. Develop and demonstrate a tomato dump tank water recycle system. 3. Compare the microbiological and physical cleanliness of tomatoes processed with conventional washing technology and the demonstration cleaning system. 4. Compare the composite wastewater streams in regard to volume, BOD and suspended solids under conventional and demonstration conditions. The approach is to use mechanical energy (spinning rubber disc) rather than hydraulic energy (water) to cleanse the surface of tomatoes. Physical-chemical systems are being used to separate inert matter from the spent dump tank process water; and after reclamation this water is returned for reuse. EPA CONTACT: Harold W. Thompson

G203–0113 SIC 203 FOOD PRODUCTS GRANT NO. 803825

Reduction of Waste in the Pickling Industry by Brine Recycling Pickle Packers International 108–1/2 East Main Street St. Charles, IL **PROJECT LIFE:** 05/75–03/78 **PROJECT COST:** $124,100 ($84,400)

Total recycling of cucumber fermentation brines would eliminate waste, which normally contains 11–15% NaCl and 12,000–15,000 mmp BOD, from pickle plant effluents. This project will provide a side by side test of two recycling procedures which have given good results in laboratory and commercial trials. This will provide an excellent comparison of relative costs, advantages and disadvantages of each alternative. The two recycling treatments to be compared are pasteurization and chemical precipitation. In addition to evaluation of product quality and waste reduction, this project will provide data on the safety of the recycling process by analyzing brines for buildup of heavy metals, pesticide and herbicide residues, and the production of toxic compounds. Specific study objectives are: 1. Demonstrate on a commercial scale total recycling of spent brines produced during pickle fermentations. 2. Determine whether significant build up of potentially toxic substances will occur with recycling. 3. Determine the degree of reduction of waste effluents which can be attained by implementation of brine recycle. EPA CONTACT: Harold W. Thompson

G203–0115 SIC 203 FOOD PRODUCTS GRANT NO. 802958

Minimization of Water Use in Leafy Vegetable Washers Virginia Polytechnic Institute and State University Blacksburg, VA **PROJECT LIFE:** 05/74–01/78 **PROJECT COST:** $58,900 ($44,200)

An experimental low water use leafy green vegetable washer was installed and evaluated at a commercial processing facility. The wastewater from this washer and from a conventional washer will be characterized and compared. The quality of experimentally and conventionally washed leafy greens will be monitored and compared. Based on initial results, product quality remained high while water demand was reduced by 77%. EPA CONTACT: Harold W. Thompson

CURRENT PROJECTS ABSTRACTS SECTION

G203–0116 SIC 203 FOOD PRODUCTS GRANT NO. 804220

Reducing Wastewater from Cucumber Pickling Process by Controlled Culture Fermentation North Carolina A&T State University Department of Plant Science Carver Hall Greensboro, NC **PROJECT LIFE:** 09/75–06/77 **PROJECT COST:** $64,200 ($50,200)

The summary objective of this project is to demonstrate on a commercial scale the reduction in mass emission rates possible via the replacement of the cucumber natural fermentation process with the controlled culture fermentation process. Specific objectives are: 1. Demonstrate substantial reduction in salt and water usage in brining and processing cucumbers by substitution of the controlled fermentation procedure (approx. 251 salometer brining) for the current natural fermentation procedure (50–651). 2. Compare product quantity and quality of pickles made from brinestock produced by controlled fermentation with those produced by the conventional natural fermentation procedure. 3. Compare waste streams (volume, oxygen demand, organic carbon, solids, chlorides, N and P forms) under conventional and demonstration conditions. EPA CONTACT: Harold W. Thompson

G203–0117 SIC 203 FOOD PRODUCTS GRANT NO. 804597

The Unit Kernel Sweet Corn Process Modification American Frozen Food Institute 919 – 18th Street, N.W. Washington, DC **PROJECT LIFE:** 07/76–04/78 **PROJECT COST:** $36,400 ($36,400)

The objective of this project is to verify and demonstrate proposed sweet corn processing modifications which will increase yield, reduce energy use, and reduce effluent mass emission rates. The proposed modifications are directed toward the production of "unit" or uncut kernels for freezing and canning. Effluent mass emission rates are reduced when processing unit kernels due to the significant reduction in the extent of cut surfaces exposed to wash and blanching water. Yield is increased by reducing the quantity of soluble solids being removed from the corn during the blanching and washing steps, and by recovering a greater portion of the kernel from the cob. Methods under investigation for producing unit kernels include a coring procedure in which the kernels are sawed off the cob at a point below the kernel tip. These kernels are then cleaned to eliminate extraneous cob tissue. A second method produces unit kernels by rubbing or rolling kernels from their sockets in the cob after the cob itself has been split into two or more lengthwise sections. If successful these unit kernel processes may be applicable to in-field processing which would allow the corn cob and husks to remain in the field. EPA CONTACT: Harold W. Thompson

G203–0122 SIC 203 FOOD PRODUCTS CONTRACT NO. 68–01–3289

Dewatering and Disposal of Sugarbeet Transport Mud Sverdrup, Parcel and Associates 800 North 12th Boulevard St. Louis, MO **PROJECT LIFE:** 10/76–10/77 **PROJECT COST:** $59,000 ($59,000)

Beet sugar processing plants produce large quantities of wastewaters as a result of transporting and washing sugar beets. The management of these wastewaters which contain large quantities of solids is a major environmental problem. A recent management development has been the dewatering of beet transport muds via vacuum filtration. The over all objective of this contract is to evaluate a full scale vacuum dewatering system which has been installed at a new beet sugar processing facility. This evaluation will include a technical and economic assessment of the installed solids separation, dewatering and ultimate disposal system. EPA CONTACT: Harold W. Thompson

G203–0475 SIC 203 FOOD PRODUCTS GRANT NO. 803997

Evaluation of Waste Citrus Activated Sludge in Poultry Feeds University of Florida Department of Poultry Science S.W. Archer Road, I.F.A.S. Gainesville, FL **PROJECT LIFE:** 07/76–04/79 **PROJECT COST:** $32,000 ($23,500)

A series of broiler feeding trials will be used to determine the metabolizable energy content, protein quality and phosphorus availability of waste citrus activated sludge. The degree of vitamin D destruction by citrus sludge will also be studied. The pigmenting value of the product will be determined using white corn diets for 4–8 week old broilers and laying hens. Steps will be made to obtain FDA approval of waste citrus activated sludge as a poultry feed ingredient. Specific study objectives are: 1. Determine the degree of interaction between citrus waste activated sludge and vitamin D_3 in broiler diets. 2. Evaluate the biological availability of phosphorus contained in citrus waste activated sludge. 3. Evaluate the protein quality of citrus sludge. 4. Determine the pigmenting value of citrus sludge in egg yolks and the breast skin and and shanks of broilers. EPA CONTACT: Harold W. Thompson

G204–0120 SIC 204 FOOD PRODUCTS GRANT NO. 12060 DPE

Treatment of Wastes from the Wet-Milling Industry Corn Products Company Corporate Engineering P.O. Box 345 Argo, IL **PROJECT LIFE:** 07/68–12/76 **PROJECT COST:** $4,656,400 ($482,680)

This project entails the design, construction, operation, and an economic and technical evaluation of a 1 mgd, completely mixed aerobic system for treatment of corn refining wastes. EPA CONTACT: Larry Dempsey

CURRENT PROJECTS ABSTRACTS SECTION

G206–0123 **SIC 202 FOOD PRODUCTS** **GRANT NO. 801221**

Ecostatic Cane Processing System—Pilot Phase County of Hawaii 25 Aupuni Street Hilo, HI **PROJECT LIFE:** 06/72–02/77 **PROJECT COST:** $979,390 ($109,000)

The applicant proposes to pilot plant several systems on a large scale which, if successful, would result in the processing of raw cane sugar with no discharge of liquid wastes to the environment and provide proper handling techniques for the various forms of solid waste. Systems to be evaluated include: a field harvester-cleaner, a dry cane cleaner, a juice wet cane cleaner (with juice added back to the process stream), a trash dry cleaner, a trash wet cleaner with silt removal and complete recycle of water, and a stabilized slope disposal system for thickened muds. EPA CONTACT: Kenneth A. Dostal

G206–0124 **SIC 206 FOOD PRODUCTS** **GRANT NO. 802420**

Ecostatic Cane Processing System—Prototype Phase Hilo Coast Processing Co. P.O. Box 18 Pepeekeo, HI **PROJECT LIFE:** 08/73–04/77 **PROJECT COST:** $7,387,900 ($479,000)

The overall objective of this project was to demonstrate a systems environmental management approach, from field to final product, for the processing of raw cane sugar. Specific sub-systems which were to be developed and demonstrated as part of this systems approach were: (a) harvester-cleaner-transporter, (b) dry cane cleaner, (c) juice washing of dry cleaned cane, (d) soil and wastewater disposal, (e) cane trash wet cleaner, and (f) fiberous wastes burned for the generation of commercial electrical power. While the systems approach is a viable one for waste reduction, it suffers from the weakness that if one sub-system fails to operate as expected it directly affects the successful operation of all or part of the total system. In this study the failure of the harvester-cleaner-transport system led directly to the failure of the juice washing and trash cleaning concepts. In addition, it hampered the successful operation of all the other subsystems. EPA CONTACT: Harold W. Thompson

G208–0119 **SIC 208 FOOD PRODUCTS** **GRANT NO. 12060 EUZ**

Winery Wastewater Characterization and Treatment Widmer's Wine Cellars, Inc. Naples, NY **PROJECT LIFE:** 12/69–01/77 **PROJECT COST:** $284,000 ($148,900)

This project includes design, construction, and operation of an extended aeration waste treatment plant to treat the process wastewaters from a winery. The objectives of the project are the following: 1. characterization of the winery wasteflow, 2. design, construction and operation of an extended aeration waste treatment system, 3. study and documentation of the treatment system, 4. optimization of the system, 5. determination of the effectiveness of nutrient addition to the operation of the system. The facility will be designed for a 120,000 gpd flow. EPA CONTACT: Larry Dempsey

G209–0082 **SIC 209 FOOD PRODUCTS** **GRANT NO. 12060 FUR**

Membrane Separation of Soybean Whey for Product Recovery and Waste Treatment Central Soya Company, Inc. 1825 North Laramie Avenue Chicago, IL **PROJECT LIFE:** 09/70–06/77 **PROJECT COST:** $143,750 ($86,825)

During this project, the applicant will design, construct, and operate a pilot-scale membrane separation process for the treatment and product recovery from a soybean whey waste discharge. The pilot-scale facility will process 700 gallons per day of soybean whey and the operational data from the project will be used to establish the design scale-up factors and economic feasibility of a commercial size facility. The treatment and recovery system will consist of a two-stage membrane separation unit followed by an evaporation process. The system will be designed to handle a soybean whey discharge which in its diluted condition has a 4700 mg/1 BOD, a 10,100 mg/1 COD, a pH of 4.6 and a solids concentration of 15,000 mg/1. EPA CONTACT: Clifford Risley

G209–0099 **SIC 209 FOOD PRODUCTS** **GRANT NO. 802338**

Shrimp Cannery Wastewater Treatment American Shrimp Canners Association P.O. Box 50744 New Orleans, LA **PROJECT LIFE:** 07/74–12/77 **PROJECT COST:** $319,060 ($239,295)

The project is a full scale demonstration treatment system for a typical shrimp cannery. The objective is to develop and demonstrate (a) efficient in-plant water use, (b) cannery process changes, (c) efficient screening, (d) dissolved air flotation with chemical addition and sludge concentration, and (e) pilot testing of process re-use of treated effluent. Various chemical coagulants, polymers, pH control and variations in flotation process are to be tested. Operational data will be assembled and evaluated. EPA CONTACT: Kenneth A. Dostal

CURRENT PROJECTS ABSTRACTS SECTION

G209-0100 SIC 209 FOOD PRODUCTS GRANT NO. 803911

Skokomish Salmon Processing Waste Treatment Systems Monitoring and Evaluation Skokomish Tribal Council Shelton, WA **PROJECT LIFE:** 08/75–07/77 **PROJECT COST:** $99,100 ($84,800)

The proposed study is intended to evaluate the performance of the newly installed extended aeration and aerobic pond systems for the treatment of salmon processing waste water. The systems will be examined at various operation conditions. The results will be analyzed to determine if the control efficiencies of the systems are adequate to meet the subject process waste effluent limitations (operational modifications will be made in order to improve systems performance when necessary). Meanwhile, treated water quality will be evaluated to determine its feasibility for salmonid propagation and processing. This type of investment will improve employment opportunity and economy of the tribal community. Both extended aeration and aerobic ponds systems constructed near the countil's salmon processing plant in Shelton, WA provide the flexibilities for flow bypassing and adjustments. These flexibilities will allow the investigators to evaluate the systems at various conditions. The results will be reduced to useful forms. The engineering criteria will be derived/documented for future design application. These design criteria derived will be very useful and extremely important to fish processing waste control due to the lack of data available to date. EPA CONTACT: Kenneth A. Dostal

K301-0127 SIC 301 MISCELLANEOUS CONTRACT NO. 68-02-1874

Source Assessment—Rubber Processing Industry Monsanto Research Corporation Dayton, OH **PROJECT LIFE:** 04/75–03/77 **PROJECT COST:** $95,100 ($95,100)

The objective is to obtain data on the environmental impact of emissions from rubber processing operations. The approach is the evaluate rubber process operations, identify potentially toxic and hazardous materials emitted, develop and implement a comprehensive plan for sampling and analysis and evaluate the environmental impact of emissions from rubber operations. EPA CONTACT: Ronald Turner

K311-0089 SIC 311 MISCELLANEOUS GRANT NO. 12120 DSG

Aerobic Biological Treatment, Sludge Dewatering, and Disposal and Effluent Reuse for a Side Leather Tannery S. B. Foot Tanning Company Red Wing, MN **PROJECT LIFE:** 05/68–07/77 **PROJECT COST:** $2,046,268 ($475,000)

This project will provide a full-scale demonstration and investigation of primary sedimentation, biological secondary treatment utilizing aerated lagoons, and primary and secondary sludge dewatering and disposal by means of pressure filtration and incineration. The system will treat the total waste flow of 2.1 mgd from the side leather tannery. In addition, an evaluation will be conducted to determine the influence of final treatment plant effluent reuse on hide processing and quality of the finished product by reusing it in the "limepaddle" and "wash soak" tanning operations. EPA CONTACT: Clarence C. Oster

K311-0096 SIC 311 MISCELLANEOUS GRANT NO. 804504

Demonstration of a Process to Meet Best Available Treatment Standards for Chrome Tanning Wastes A. C. Lawrence Co. Essex County Bank Bldg. Route 128 Peabody, MA **PROJECT LIFE:** 09/76–11/77 **PROJECT COST:** $280,676 ($149,140)

The primary objective of the project is to demonstrate the technical and economical feasibility of meeting BATEA limits by a chrome leather tannery utilizing electroflotation (Lectro Clear) and zonal control of dissolved oxygen in an oxidation ditch (Carrousel) to accomodate both aerobic nitrification and anaerobic denitrification. Secondary objectives are water reuse, energy conservation, and solid waste handling and utilization. The approach is to operate and closely monitor a full-scale treatment plant which has been designed to meet strict effluent limitations in a NPDES permit. The plant is to be operated to meet BATEA guidelines and the measurements of inputs and outputs made to develop cost and technical reliability. The Company is building the necessary facilities to undertake the project. The primary treatment process is complete and operational; the secondary process is under construction. EPA CONTACT: Jack L. Witherow

K311-0107 SIC 311 MISCELLANEOUS GRANT NO. 12120 EPC

Removal and Recovery of Sulfide From Tannery Wastes Blueside Real Estate, Inc. 800 N. Atlantic Avenue Kansas City, MO **PROJECT LIFE:** 04/70–07/77 **PROJECT COST:** $388,900 ($110,950)

The basic objectives of the project are to translate pilot-plant results into the development and demonstration on a plant scale of a process for removing sulfide from the effluent of a chrome tannery and recovering the sulfide in a form reusable in the tannery. The project will demonstrate the technical feasibility of the sulfide removal method and will determine the economics of the process on a full-scale plant. EPA CONTACT: William Banks

CURRENT PROJECTS ABSTRACTS SECTION

K322–0043 SIC 322 MISCELLANEOUS CONTRACT NO. 68–01–4619

Glass Manufacturing Battelle Memorial Institute 505 King Avenue Columbus, OH **PROJECT LIFE:** 06/76–02/77 **PROJECT COST:** $155,000 ($155,000)

The overall objective of this task is to provide a plan for obtaining actual measurement data on emissions from the glass manufacturing industry, needed to complete source assessment, form specific conclusions, and develop control technology for this industry. EPA CONTACT: Charles H. Darvin

K325–0046 SIC 325 MISCELLANEOUS CONTRACT NO. 68–02–1874

Source Assessment—Brick Kilns Monsanto Research Corporation 1515 Nicholas Road Dayton, OH **PROJECT LIFE:** 09/74–08/76 **PROJECT COST:** $100,000 ($50,000)

An indepth source assessment studying the qualitative and quantitative aspects of air pollutant emissions, as well as available technology and pollutant effect. This source assessment, which investigates all major aspects of air pollution from brick kilns, will provide information necessary to determine the immediate impact of air emissions as well as technology development. EPA CONTACT: Charles H. Darvin

K329–0031 SIC 329 MISCELLANEOUS CONTRACT NO. 68–02–1872

Field Testing of Emissions Controls from Asbestos Manufacturing Waste Piles Illinois Institute of Technology 10 West 35th Street Chicago, IL **PROJECT LIFE:** 03/75–09/76 **PROJECT COST:** $148,063 ($148,063)

In-plant field demonstration of control technology for asbestos manufacturing industry to minimize asbestos emissions from waste dumps and from waste transfer operations. The technologies include stabilization of waste dumps with chemical or vegetative coverings and application of sprays, foams, and enclosures to reduce emissions from active dumping operations. The Johns-Manville asbestos pipe manufacturing plant at Denison, Texas, is the location of this study. This facility uses modern equipment to satisfactorily control the asbestos emissions from the manufacturing process itself. The sources of asbestos emissions are weathering of two waste piles, active and inactive, and dumping of waste as well as crushing of large aggregates on the active pile. EPA CONTACT: Mary Stinson

K329–0407 SIC 329 MISCELLANEOUS CONTRACT NO. 68–01–2906

Optimizing Performance Characteristics of Baghouses for Asbestos Collection Illinois Institute of Technology Research Institute 10 West 35th Street Chicago, IL **PROJECT LIFE:** 05/76–09/77 **PROJECT COST:** $56,998 ($56,998)

It was found that the baghouse equipped with a cotton bag was regarded as the most efficient means of asbestos control. This study will investigate the possibility of optimum operating conditions to improve the efficiency of baghouse. The following will be performed: 1. site selection for on site testing, 2. establishing base emission level and operating parameters, 3. determination of the modifications needed, 4. full scale on site demonstration of a modified baghouse under optimal operating conditions. EPA CONTACT: Mary Stinson

O330–0032 SIC 330 NON-FERROUS METALS GRANT NO. 804377

Activated Alumina Process for Removing Fluoride from Waste Waters Feldspar Corporation Spruce Pine, NY **PROJECT LIFE:** 05/76–05/77 **PROJECT COST:** $57,697 ($45,000)

The objective of this project is to develop an activated alumina process for removing fluoride in wastewaters to low levels. Bench-scale and pilot plant studies will be carried out to investigate the technical and economical feasibility of the removal process. EPA CONTACT: Mary Stinson

O330–0155 SIC 330 NON-FERROUS METALS CONTRACT NO. 68–01–2984

Support for Yugoslavia and Polish Excess Foreign Currency Project Pedco Environmental Suite 13, Atkinson Square Cincinnati, OH **PROJECT LIFE:** 05/76–12/76 **PROJECT COST:** $13,000 ($13,000)

Two excess foreign currency projects are included in the nonferrous metals program. The three year study in Poland will characterize a Hoboken convertor system and SO_x removal systems for primary copper smelters. The three year study in Yugoslavia will concentrate on development of improved techniques for cleaning high temperature effluent gases in metallurgical operations. EPA CONTACT: Margaret Stasikowski

CURRENT PROJECTS ABSTRACTS SECTION

0330–0161 SIC 330 NON-FERROUS METALS GRANT NO. 804595

A Research Investigation of New Techniques for Control of Smelter Arsenic Flu Dust Wastes Montana Technology Foundation P.O. Box 3708 Butte, MT **PROJECT LIFE:** 07/76–12/78 **PROJECT COST:** $173,000 ($185,000)

The objective of the grant is to develop recovery and fixation techniques for arsenic and other heavy metals from smelter flu dusts. The proposed study will be a two year effort. Phase I will be a laboratory, small pilot plant investigation and a literature review study. Actual flu dusts from the Anaconda and other smelters will be tested. Development of the recovery process will involve consideration of several leaching techniques for removal of heavy metals including arsenic. The study of fixation techniques will involve first, literature survey to identify the most prospective techniques followed by bench scale studies of at least two or three fixation techniques using the actual smelter flu dusts. The study will then be followed by a pilot scale work. EPA CONTACT: John C. Burkle

0330–0168 SIC 330 NON-FERROUS METALS CONTRACT NO. 68–01–2984

Arsenic Sources and Control Technology Review Pedco Environmental 13 Atkinson Square Cincinnati, OH **PROJECT LIFE:** 06/76–08/76 **PROJECT COST:** $12,500 ($12,500)

A scientific and technical assessment report on the subject of arsenic sources and control technology will be prepared. The task will include the review and evaluation of selected literature sources. The final report will become a chapter in the EPA STAR document on arsenic. EPA CONTACT: John C. Burkle

0330–0175 SIC 330 NON-FERROUS METALS IAG NO. IAG–D4–0522

Environmental and Energy Considerations for Emerging Non-Ferrous Metal Winning U.S. Bureau of Mines 1600 E. First South Street Salt Lake City, UT **PROJECT LIFE:** 06/74–02/77 **PROJECT COST:** $40,000 ($40,000)

This Interagency Agreement with the Bureau of Mines, Salt Lake City Metallurgy Research will investigate the environmental and energy considerations of emerging non-ferrous metal winning processes. Emphasis will be on copper. Processes such as electric furnace smelting, Noranda flash smelting, Hecla-El Paso roasting-hydrometallurgical, Arbiter, Sherritt-Gordon-Cominco, Cymet, Duval "CLEAR", Mitsubishi, oxygen-enriched reverberatory furnace, converter smelting, and top blown rotary converter (TBRC) processes will be examined. EPA CONTACT: Margaret Stasikowski

0330–0177 SIC 330 NON-FERROUS METALS CONTRACT NO. 68–02–1319

Pollution Control and Heat Recovery from Non-Ferrous Smelters Radian Corporation 8500 Shoal Creek Boulevard Austin, TX **PROJECT LIFE:** 09/75–10/76 **PROJECT COST:** $100,000 ($100,000)

The objective of the program is to examine the primary and secondary non-ferrous smelting industries for the potential to recover waste-heat and reduce emissions. The program will assess current smelting practices, potential near term changes, waste-heat recovery techniques applicable to the smelter industry, and evaluate feasibility of application of these techniques. In the first stage the state-of-the-art in smelting practices and waste-heat recovery techniques applicable to the primary and secondary non-ferrous smelting industries will be defined. For each potential heat recovery system, a process flow chart will be prepared and a mass/energy balance performed. A determination will be made of the quantity of heat available and the expected change in mass emissions due to waste-heat recovery. In the next stage, the potential benefits from the selected heat recovery techniques on a national scale will be estimated. The final report will include recommendations for specific RD&D demonstrations. EPA CONTACT: Margaret Stasikowski

0333–0149 SIC 333 NON-FERROUS METALS CONTRACT NO. 68–02–1321

Environmental Assessment of Primary Copper, Lead and Zinc Industries Pedco-Environmental Suite 13, Atkinson Square Cincinnati, OH **PROJECT LIFE:** 11/75–06/76 **PROJECT COST:** $67,000 ($67,000)

The objective of the project is to conduct a comprehensive environmental assessment of the primary copper, lead and zinc industries. An indepth characterization of the processes in the industries will be conducted. Processes will include mining, transporting from mine to process, processing of ores to concentrates, concentrates to metals, and production of finished products. The environmental insults from these industries will be determined. This will include air, and water pollution as well as solid waste generated. The project will not only consider regulated pollutants, but also those which might be regulated in the future and/or are considered to have negative effects on health and ecology. Inputs on the pollutants to include in the study will be sought from other parts of ORD, EPA and outside experts. Where no data is available on the pollutants emitted for a particular branch of the industry, a sampling and analysis needed will be recommended. EPA CONTACT: Margaret Stasikowski

CURRENT PROJECTS ABSTRACTS SECTION

0333-0150 SIC 333 NON-FERROUS METALS CONTRACT NO. 68-02-1323

Environmental Assessment of Primary Non-Ferrous Industry Except Copper, Lead and Zinc Battelle Columbus Laboratories 505 King Avenue Columbus, OH **PROJECT LIFE:** 11/75–06/76 **PROJECT COST:** $107,000 ($107,000)

The objective of the project is to conduct a comprehensive environmental assessment of the primary aluminum, antimony, beryllium, columbium-tantalum, manganese, mercury, molybdenum, nickel, magnesium-platinum group metals, rare-earth metals, thorium, tin, tungsten, zirconium metals industries. An indepth characterization of the processes in the industries will be conducted. Processes will include mining, transporting from mine to process, processing of ores to concentrates, concentrates to metals, and production of finished ingots where applicable. The environmental insults from these industries will be determined. This will include air and water pollution as well as solid waste generated. The project will not only consider regular pollutants but also those which might be regulated in the future and/or are considered to have negative effects on health and ecology. Inputs on the pollutants to include in the study will be sought from other parts of ORD, EPA and outside experts. Where no date is available on the pollutants emitted for a particular branch of the industry, a sampling and analysis needed will be recommended. EPA CONTACT: Margaret Stasikowski

0333-0152 SIC 333 NON-FERROUS METALS CONTRACT NO. 68-02-1319

Source Sampling and Analysis in Non-Ferrous Metals Industry Radian Corporation P.O. Box 9948 Austin, TX **PROJECT LIFE:** 02/76–12/76 **PROJECT COST:** $106,000 ($106,000)

The objective of this project is to start a source characterization program which will complete the data gap now existing relative to the quantity and identity of emissions from the non-ferrous metals industry. The first sampling will be conducted for a primary copper smelter and will include collection of both particulate and gaseous phase emissions into the atmosphere (inlet and outlet of ESP following reverberatory furnace). Subsequent analysis will be conducted for trace metals both in gaseous and solid phase. For the solid phase, analysis will be conducted for four size cuts of collected material. Sampling and analysis for sulfates will be conducted. Mass balance around the electrostatic precipitator will be performed. EPA CONTACT: Margaret Stasikowski

0333-0154 SIC 333 NON-FERROUS METALS CONTRACT NO. 68-02-2398

Characterization of Copper Smelter Reverberating Furnace Operation, Definition and Evaluation of SO_2 Control Techniques Pacific Environmental Services, Inc. 1930 14th Street Santa Monica, CA **PROJECT LIFE:** 05/76–11/77 **PROJECT COST:** $157,000 ($157,000)

The objective of this project is to undertake a technical feasibility study of alternative ways by which it would be possible to obtain control of the SO_2 emissions from a reverberatory furnace in primary copper smelting operations. At the present time, the U.S. copper industry claims that reverberatory furnace is the only economical way of processing dirty copper concentrates. The waste gases emitted from a reverberatory furnace contain small and variable concentrations of SO_2 which cannot be fed into an autothermally operated sulfuric acid plant. An exemption is included in the New Source Performance Standards for copper smelters processing dirty concentrates. EPA CONTACT: Margaret Stasikowski

0333-0156 SIC 333 NON-FERROUS METALS CONTRACT NO. 68-02-1325

Feasibility of Copper Smelter Waste Gases Blending Research Triangle Institute Research Triangle Park, NC **PROJECT LIFE:** 02/76–12/76 **PROJECT COST:** $83,000 ($83,000)

The objective of the project is to investigate particular aspects of gas streams blending in the copper smelter (including waste gases from reverberatory furnaces) in trying to establish it as a viable technique for controlling lean SO_2 streams. This project is a fourth and final one evaluating the technology of blending lean SO_2 streams from reverberatory furnaces with stronger roaster and converter streams for control of SO_x emissions in a sulfuric acid plant. Other projects investigated the roles of roaster operation, acid plant operation and reverberatory gas characteristics. This project will provide further investigation of gas stream blending technology. It will combine the results of previous projects to estimate the necessary requirements for use of gas blending under a variety of different smelting process schemes. Recommendations will be made regarding further work necessary to develop blending as an alternative to control of lean SO_2 reverberatory furnace gas streams. Results of the study will be used in project 02-01-02A-01 Control of Lean SO_2 Streams from Copper Smelter Reverberatory Furnaces. EPA CONTACT: Margaret Stasikowski

0333-0163 SIC 333 NON-FERROUS METALS GRANT NO. TF2-570-1

High Temperature Gas Cleaning in Non-Ferrous Metallurgy Trepca Lead and Zinc Institute Kosovska Mitrovca, Yugoslavia **PROJECT LIFE:** 07/75–12/79 **PROJECT COST:** $380,000 (PL-480)

The objective of the study is to develop improved techniques for cleaning high temperature effluent gases in metallurgical operations. Specific objectives are to lower capital investment and energy costs and improve collection efficiency. Conceptual designs for full scale systems will be developed. EPA CONTACT: John C. Burkle

CURRENT PROJECTS ABSTRACTS SECTION

0333-0173 SIC 333 NON-FERROUS METALS CONTRACT NO. 68-02-1321

Secondary Hooding of Pierce-Smith Converters Pedco Environmental Suite 13, Atkinson Square Cincinnati, OH **PROJECT LIFE:** 05/76–12/76 **PROJECT COST:** $14,000 ($14,000)

In the proposed NSPS for primary copper smelters no fugitive emissions were treated because of the lack of information on the sources and control technology available. The most important source of fugitive emissions in primary copper smelters is a Pierce-Smith converter. Most of the emissions occur during its charging and slagging. The objective of this project is to develop a satisfactory system of secondary hooding for PierceSmith converters which are used in the majority of the U.S. primary copper smelters. This will be done by looking at the past attempts to develop secondary hooding (for example, Kennecott, Garfield smelter) and developing an optimal design which can be used by the U.S. smelters. EPA CONTACT: Margaret Stasikowski

0333-0174 SIC 333 NON-FERROUS METALS GRANT NO. 05-533-5

Optimization of Air Pollution Control for Copper Smelters Institute of Non-ferrous Metals Sowinskiego 5 Gliwice, Poland **PROJECT LIFE:** 03/75–10/78 **PROJECT COST:** $333,000 (PL-480)

The objective of the study is to evaluate particulate and gaseous emissions from a Hoboken converter in a primary copper smelter. This type of a converter has promise for significantly decreasing fugitive emissions. In addition to the evaluation of emissions, copper smelter operating parameters will be measured to identify the limits of the Hoboken converter operation. EPA CONTACT: George Thompson

0333-0176 SIC 333 NON-FERROUS METALS CONTRACT NO. 68-02-1323

Development of Methodology for Maintaining Continuous Awareness in Non-Ferrous Metals Industry Battelle Memorial Institute 505 King Avenue Columbus, OH **PROJECT LIFE:** 03/76–07/76 **PROJECT COST:** $35,000 ($35,000)

The objective of this task is to develop methodology which will provide an effective means for continuing review and assessment of environmental impacts of the state-of-the-art and new metal winning technologies. The resulting final report will include recommendations for the adoption of methodology. EPA CONTACT: Margaret Stasikowski

0333-0433 SIC 333 NON-FERROUS METALS GRANT NO. 804762

Assessment of Electrostatic Precipitator Applications in NonFerrous Industries Southern Research Institute 2000 Ninth Street Birmingham, AL **PROJECT LIFE:** 06/76–09/77 **PROJECT COST:** $131,000 ($125,000)

The principal objective of the proposed project is to obtain information on the design, sizing, and application of electrostatic precipitators for the control of particulate emissions from nonferrous metalurgical sources. ESP have been used for many years to control emissions from ore roasters and smelters in the production of copper, lead, and zinc, and more recently in the electrolytic production of aluminum. However, the sizing of precipitators has been based on lower efficiencies than are now required to meet state and federal emission standards. EPA CONTACT: Margaret Stasikowski

0334-0151 SIC 334 NON-FERROUS METALS CONTRACT NO. 68-02-1319

Environmental Assessment of Secondary Non-Ferrous Metals Industry Radian Corporation P.O. Box 9948 Austin, TX **PROJECT LIFE:** 11/75–06/76 **PROJECT COST:** $69,000 ($69,000)

The objective of the project is to conduct a comprehensive environmental assessment of the secondary non-ferrous metals industry. An indepth characterization of the processes in the industries will be conducted. The industry consists of a loosely defined collection of companies engaged in non-ferrous scrap metal recycling. The environmental insults from these industries will be determined. This will include air and water pollution as well as solid waste generated. The project will not only consider regulated pollutants but also those which might be regulated in the future and/or are considered to have negative effects on health and ecology. Inputs on the pollutants to include in the study will be sought from other parts of ORD, EPA and outside experts. Where no data is available on the pollutants emitted for a particular branch of the industry, a sampling and analysis needed will be recommended. EPA CONTACT: Margaret Stasikowski

0334-0172 SIC 334 NON-FERROUS METALS GRANT NO. 804734

Algal-Meander System for Secondary Lead Smelters Syracuse University Civil Engineering Department 150 Hinds Hall Syracuse, NY **PROJECT LIFE:** 09/76–08/77 **PROJECT COST:** $33,062 ($26,319)

This study proposes to evaluate the potential of applying the algal meander treatment system to removal of trace metals from secondary lead smelter wastes. A number of algal forms and a column screening technique will be used to determine the efficiency of these algal forms at removing a variety of soluble and insoluble lead, zinc, copper, cadmium, arsenic, etc., chemical compounds. Similarly, experiments will be performed to screen the effectiveness of the algae in removing the anions often associated with these dangerous metals. If these studies are successful, then later studies will be conducted on the removal of trace organics associated with these wastes. EPA CONTACT: Don Wilson

CURRENT PROJECTS ABSTRACTS SECTION

0334-0408   SIC 334 NON-FERROUS METALS   CONTRACT NO. 68-02-1402

Evaluation of Performance of Teller Baghouse Environmental Science and Engineering P.O. Box 13454 Gainesville, FL **PROJECT LIFE:** 05/76-02/77 **PROJECT COST:** $43,000 ($43,000)

The objective of the project is to evaluate the performance of a Teller Baghouse on a secondary aluminum smelter. Tests will be conducted during chlorine demagging. Inlet and outlet of the baghouse will be sampled for gaseous and particulate phase. Analysis will be performed for SO_x, NO_x, polynuclear aromatics, and trace metals. Final report will cover the sampling and evaluation of the baghouse. EPA CONTACT: Margaret Stasikowski

0334-0434   SIC 334 NON-FERROUS METALS   CONTRACT NO. 68-02-1413

Demonstration of Emission Control for the Secondary Aluminum Smelter Rochester Smelting and Refining Co., Inc. 26 Sherer Street Rochester, NY **PROJECT LIFE:** 05/74-12/76 **PROJECT COST:** $125,000 ($125,000)

The Rochester Smelting and Refining Company, Inc. has installed Teller coated baghouse control system on their secondary aluminum smelter at Rochester, New York. The major elements of this system include: a. furnace hood and ducting collection system, b. quenching section, c. precoating and baghouse collection, d. blower and stack section. In fulfillment of this contract, the contractor shall compile a design manual, operate the Teller coated baghouse control system for a period of one year, and assist in the conduct of an emission testing and system evaluation program. EPA CONTACT: Margaret Stasikowski

0347-0001   SIC 347 NON-FERROUS METALS   CONTRACT NO. 68-02-1329

Environmental Assessment of Emissions to the Atmosphere from Electroplating and Associated Operations Battelle Memorial Institute 505 King Avenue Columbus, OH **PROJECT LIFE:** 02/76-11/76 **PROJECT COST:** $22,893 ($22,893)

The objective of this phase I study is to define and characterize the significant air pollution problems of the electroplating industries. The phase II objective is to prioritize the multimedia pollution problems of the electroplating industries. EPA CONTACT: Charles Darvin

0347-0003   SIC 347 NON-FERROUS METALS   GRANT NO. 803717

Controlled System for Disposing of Metal Finishing Sludges New Jersey Institute of Technology 323 High Street Newark, NJ **PROJECT LIFE:** 03/76-07/77 **PROJECT COST:** $121,391 ($70,000)

Full scale demonstration of lined lagoon with trenches containing relatively inexpensive highly selective media for removing toxic components that leach from metal finishing sludges. Previous bench scale study has established the effectiveness of different media for removing the various toxic constituents found in leachates from metal finishing and other industrial sludges. There is an immediate need for controlled disposal of potentially hazardous solid wastes to protect high quality ground waters from leachates. Development and demonstrations are underway for recovering heavy metals from sludges but are not expected to make a significant impact in the near future. EPA CONTACT: Fred Ellerbusch

0347-0005   SIC 347 NON-FERROUS METALS   GRANT NO. 804648

Treatment of Metal Finishing Wastes by Sulfide Precipitation Holley Carburetor 11955 E. Nine Mile Road Warren, MI **PROJECT LIFE:** 06/76-09/77 **PROJECT COST:** $144,361 ($40,000)

In-plant demonstration of unique sulfide precipitation process for removing heavy metals from metal finishing waste waters down to very low levels. Economics and effectiveness of process for removal of several heavy metals will be determined under actual production conditions. Previous pilot plant study optimized the process. EPA CONTACT: Dan Wilson

0347-0012   SIC 347 NON-FERROUS METALS   GRANT NO. 804656

Activated Carbon Process for Chrome Plating Wastewater University of Delaware Newark, DE **PROJECT LIFE:** 09/76-10/77 **PROJECT COST:** $37,326 ($35,414)

Full scale demonstration of a precipitation/adsorption approach to metal finishing waste treatment which removes metals to below their solubility limit. The use of coagulant which improves agglomeration of the suspended matter and adsorbs the heavy metals provides the very low metal levels. A special ultrafiltration tube assures a highly purified treated effluent. EPA CONTACT: Mary Stinson

CURRENT PROJECTS ABSTRACTS SECTION

O347–0016 SIC 347 NON-FERROUS METALS GRANT NO. 804434

Recovery of Metal from Sludge Produced by Internal Chemical Treatment Houdaille Industries, Inc. 900 Ninth Avenue Huntington, WV **PROJECT LIFE:** 06/76–12/77 **PROJECT COST:** $115,930 ($68,710)

Full scale demonstration of a process of recovering nickel from sludge produced by integrated chemical rinsing of plated parts. The study will evaluate the effectiveness and economics of this metal recovery process under actual plant conditions. EPA CONTACT: Mary Stinson

O347–0017 SIC 347 NON-FERROUS METALS GRANT NO. 804311

Investigation of Reverse Osmosis Membranes for Plating Waste Treatment American Electroplaters' Society 56 Melmore Avenue Cambridge, MA **PROJECT LIFE:** 01/76–10/77 **PROJECT COST:** $44,185 ($41,976)

The objective of the project is to carry out pilot scale testing of several recently developed reverse osmosis membranes to evaluate their potential for providing expanded and/or improved treatment of various types of metal finishing rinse wastewaters. EPA CONTACT: Mary Stinson

O347–0018 SIC 347 NON-FERROUS METALS GRANT NO. 803753

Membrane Processes for Treatment of Metal Finishing Wastes American Electroplaters' Society, Inc. 56 Melmore Gardens East Orange, NJ **PROJECT LIFE:** 06/75–09/77 **PROJECT COST:** $69,553 ($66,173)

Field tests of reverse osmosis to treat zinc cyanide plating wastes. The membrane that will be applied in the field tests is PA-300 by Universal Oil Products. EPA CONTACT: Mary Stinson

O347–0020 SIC 347 NON-FERROUS METALS GRANT NO. 803620

Development of Reverse Osmosis Membrane for Chromic Acid American Electroplaters' Society, Inc. 56 Melmore Gardens East Orange, NJ **PROJECT LIFE:** 03/75–07/77 **PROJECT COST:** $50,000 ($47,500)

This project is a laboratory study to develop a polybenzimidazo (PB1) reverse osmosis membrane for treating oxidizing and low or high pH metal finishing rinsewaters. Preliminary tests on chromic acid rinsewater have demonstrated that the PB1 membrane adequately reject chromium ions and is stable in oxidizing solutions at high temperatures and extreme pH's. The successful development of the PB1 membrane will significantly expand the application of reverse osmosis for recovering chemicals and purifying metal finishing rinsewater for reuse. EPA CONTACT: Mary Stinson

O347–0021 SIC 347 NON-FERROUS METALS GRANT NO. 803742

Nickel Recovery and Pollution Control by Electrodialysis Risdon Manufacturing Co. Wire Goods Division P.O. Box 231 Waterbury, CT **PROJECT LIFE:** 06/75–11/77 **PROJECT COST:** $39,016 ($35,500)

A full scale electrodialysis (ED) unit will be constructed at Risdon Manufacturing to demonstrate on line the economic and environmental feasibility of ED on nickel plating line rinse waters. The scope of work encompasses optimization and continuous monitoring of the unit for nickel removal rate, selectivity and life of the membrane, sensitivity to shock loads, and the fate of minor organic and inorganic rinse bath constituents. Electrodialysis has demonstrated to be highly effective for removal and concentration of other metals in previous studies making possible the recovery of this valuable resource potentially economical, and closed loop control feasible. EPA CONTACT: Fred Ellerbusch

O347–0022 SIC 347 NON-FERROUS METALS GRANT NO. 804655

Dialysis Purification of Metal Finishing Rinse Waste Water Seaboard Manufacturing Co. 50 Theshmeadow Road West Haven, CT **PROJECT LIFE:** 09/76–09/77 **PROJECT COST:** $37,760 ($25,000)

Full scale demonstration will be conducted to evaluate the effectiveness and economics of using a new attractive membrane for closing the loop on a metal finishing rinse waste under actual production conditions. EPA CONTACT: Mary Stinson

CURRENT PROJECTS ABSTRACTS SECTION

O347–0145 SIC 347 NON-FERROUS METALS GRANT NO. 803467

Reduced Pollution Corrosion Protection Systems Dr. George E. F. Brewer 11065 E. Grand River Road Brighton, MI **PROJECT LIFE:** 12/74–12/75 **PROJECT COST:** $17,349 ($16,481)

The proposed program to develop reduced-pollution corrosionprotection systems as viable alternatives to presently used higher-pollution systems consists of the following major tasks: 1. Selection and optimization of reduced-pollution corrosionprotection systems. 2. Testing of optimized protective coating systems. 3. Economic and environmental evaluation of optimized protective coating systems. Coating parameters will be optimized for application of the reduced-pollution corrosionprotection systems on typical aerospace and metal fabrication industry substrates. The optimized coating systems will be comprehensively evaluated to establish confidence in their use by prospective metal finishing firms. The economic aspects of the selected coating systems will be determined with respect to environmental control procedures, processing requirements, coating life and operating costs. EPA CONTACT: Hugh Durham

O347–0146 SIC 347 NON-FERROUS METALS CONTRACT NO. 68–02–2075

Hydrocarbon Study DeBell and Richardson Water Street Enfield, CT **PROJECT LIFE:** 07/75–02/77 **PROJECT COST:** $1,000,000 ($250,000)

The objectives of this program are two fold: to develop a firm technical body of information concerning coating operations and processes, release of organic emissions, and cost effectiveness of control techniques—both equipment and new coatings—within the surface coating industry; and to develop Standard Support Documents which will recommend and substantiate New Source Performance Standards to limit emissions from surface coating operations. EPA CONTACT: Charles H. Darvin

O347–0421 SIC 347 NON-FERROUS METALS CONTRACT NO. 68–02–1874

Source Assessment—Tank Truck, Tank Car and Drum Cleaning and Refurbishing Industry Monsanto Research Corporation Dayton, OH **PROJECT LIFE:** 07/76–09/77 **PROJECT COST:** $65,000 ($65,000)

The objective is to identify the impact on the environment from the atmospheric emissions from cleaning and reconditioning of tank trucks, rail tank cars and drums. The approach is to identify the companies involved in the cleaning of tank cars tank trucks and reconditioning of drums, assess the existing pollution control technology, identify hazardous and potentially hazardous materials emitted, produced or used and identify areas where new or improved technology is required. EPA CONTACT: Ronald Turner

R249–0078 SIC 249 PULP, PAPER & WOOD GRANT NO. 804306

Totally Closed White Water System for the Manufacture of Fiberboard by the Wet Process System Superior Fiber Products, Inc. North 5th Street & Bayfront Superior, WI **PROJECT LIFE:** 03/76–03/77 **PROJECT COST:** $623,099 ($100,000)

Superior Fiber will enter into an agreement with Isell, and with their assistance install and operate equipment with the goal of recycling 100% of the process water. The equipment is to be installed, and the amount of discharge decreased until there is no discharge, product quality deteriorates, or operating problems occur. When problems occur, Superior Fiber will consult with Isell and will attempt solutions in an available pilot plant. During the recycle attempts, Superior Fiber will be paying close attention to all product quality parameters, quantity of water usage at all locations in the mill, white water quality, and discharged water quality. EPA CONTACT: Victor Dallons

R260–0053 SIC 260 PULP, PAPER & WOOD CONTRACT NO. 68–02–1323

Multiple-Media Pollution Assessment in Wood Products Industry Battelle Columbus Laboratories 505 King Avenue Columbus, OH **PROJECT LIFE:** 03/76–09/76 **PROJECT COST:** $60,000 ($60,000)

This contract is concerned with development of background needed for preliminary identification of R&D needs for the wood products industries (excluding wood preserving). The industries to be considered include, but are not limited to, the following: Intermediate Process—pulp mills, papermills, paperboard mills, veneer plywood, particleboard members, millwork and structural members, gum and wood chemicals; Final Goods and Processing—fabricated wood products, fabricated paper products. The specific steps for the investigation are as follows: 1. develop industry profile for each industry, 2. identify emission streams, and 3. identify gaps in control technology. EPA CONTACT: H. Kirk Willard

R260–008 SIC 260 PULP, PAPER & WOOD GRANT NO. 804086

A Management Strategy for Intermittent Process Losses and Variability in Effluent Loads in the Pulp and Paper Industry National Council of the Paper Industry for Air and Stream Improvement, Inc. 260 Madison Avenue New York, NY **PROJECT LIFE:** 11/75–11/78 **PROJECT COST:** $394,050 ($197,025)

Four mills with various waste collection systems will be equipped with sensors for monitoring to characterize raw waste variability for selected processes. Then a designed computer assisted waste load management program will be set up in conjunction with an operating mill, and the system will be operated to test its utility as a management strategy for in-process load control. EPA CONTACT: H. Kirk Willard

CURRENT PROJECTS ABSTRACTS SECTION

R260-0056 SIC 260 PULP, PAPER & WOOD GRANT NO. 803689

Waste Treatment Plant Modification, with In-Plant Water Recycling Simpson Lee Paper Co. Shasta Mill P.O. Box 637 Anderson, CA **PROJECT LIFE:** 07/75–06/77 **PROJECT COST:** $313,200 ($142,000)

The objective of this project is to allow the company to expand its papermaking capacity while concurrently assuring compliance with new NPDES Permit requirements from a State Agency. This includes: 1. Modifications to, and enlargement of, an existing primary waste treatment facility. 2. Replacement of an existing activated sludge secondary treatment system with a new, novel, two-stage, aerated stabilization basin system. 3. Disposal of up to 35% of the fully treated secondary effluent to companyowned land, via flood irrigation. 4. In-plant water conservation and recycling, to conserve energy and reduce fresh water usage by up to 30%. 5. Extending a fisheries protection program, including bioassays on salmonoid species of fish, and fertilization and growth rate studies at high effluent concentrations. The company's Shasta Mill includes a bleached kraft pulp mill, a paper mill for coated and fine papers, and a bleached groundwood mill. For item 3, above, this is the first time that a manufacturing plant of this kind has attempted large-scale land disposal of a liquid effluent. EPA CONTACT: H. Kirk Willard

R260-0072 SIC 260 PULP, PAPER & WOOD GRANT NO. 804019

Pilot Investigation of Secondary Sludge Dewatering Alternatives National Council of the Paper Industry for Air and Stream Improvement, Inc. 260 Madison Avenue New York, NY **PROJECT LIFE:** 08/75–10/76 **PROJECT COST:** $59,050 ($25,000)

The grantee plans to compare different sludge dewatering techniques on sludge produced by extended aeration biological treatment of integrated kraft mill wastes. Technology presently in use as well as novel techniques will be evaluated and compared using the same sludge feeds. Processes to be studied are: centrifuge, plate and frame pressure filter, ultrafiltration, membrane sludge concentrator, moving belt press, capillary suction device, and rotary knife precoat filter. Project objectives are to: (a) investigate the effects of applicable operating variables on each dewatering technique cited above, (b) define a range of feasible operating conditions for each, (c) identify those sets of operating conditions that correspond to the optimum performance levels for each technology, (d) identify operating conditions that render the technique ineffectual, and (e) translate to the degree possible the study data into full scale capital and operating costs. EPA CONTACT: Victor Dallons

R261-0052 SIC 261 PULP, PAPER & WOOD CONTRACT NO. CI 76-0149

Post Biological Solids Characterization and Removal from Pulp Mill Effluent CH2M Hill Consulting Engineers 1600 SW Western Boulevard Corvallis, OR **PROJECT LIFE:** 07/76–01/77 **PROJECT COST:** $46,770 ($50,770)

This project shall characterize post-biological solids discharged from various pulp and paper mills and evaluate alternate technology for effluent TSS reduction. This project is considered the first of two phases. This first phase is divided into three sub-phases with the following objectives: Phase Ia—Develop background information on the chemical and physical properties of effluent suspended solids from nine representative mills. Solids characterization shall be correlated to mill operation variables. Phase Ib—Develop a rational approach to polymer/conditioner selection that relates chemical selection to the basic properties of suspended solids measured in Phase Ia. Phase Ic—Solids removal technologies will be evaluated through bench scale testing. At least six unit processes shall be evaluated. EPA CONTACT: John S. Ruppersberger

R261-0054 SIC 261 PULP, PAPER & WOOD GRANT NO. 803525

Combined Membrane and Freezing Concentration of Bleaching Recycle Waters and Toxics Analyses of Mill Wastes Institute of Paper Chemistry P.O. Box 1048 1043 East South River Street Appleton, WI **PROJECT LIFE:** 02/75–05/77 **PROJECT COST:** $428,725 ($264,150)

Freeze concentration is being developed as an important new tool for concentration of dilute waters from industrial processes, as well as for salt water conversion. The Effluent Processes Group at The Institute of Paper Chemistry is advancing the development of concepts and technology for new routes to more effective, economically feasible methods of treating wash waters and other very dilute process waters deriving from the manufacture of pulp and paper. A staged system of processing these dilute wastes is evolving from these studies: 1. Recycle large flows of dilute waters to greatly reduce inflows and out-flows, and importantly also to preconcentrate the solutes. 2. Reclaim clean water for reuse and also to recover solute concentrates. 3. Treat the concentrates for disposal and for utilization of any values. Toxics analysis of representative waste types in the industry is being completed by the Institute as a supplement to the grant. EPA CONTACT: Ralph H. Scott

R261-0057 SIC 261 PULP, PAPER & WOOD GRANT NO. 12040 EJU

Production and Use of Activated Carbon for Water Renovation in Kraft Pulp and Paper Mills **St. Regis Paper Company 150 East 42nd Street New York, NY** PROJECT LIFE: **06/69–09/75** PROJECT COST: **$1,461,562 ($878,472)**

St. Regis Paper Company proposes a program for the development of an economical system for maximum water reuse in the kraft pulp and paper industry as a means of water pollution control and conservation. This program is based on two concepts. The first is an effluent treatment cycle using activated carbon and the second is on-site carbon production and activation from readily available raw materials with full integration into the kraft mill recovery and power systems to achieve the lowest net cost of activated carbon. EPA CONTACT: John S. Ruppersberger

CURRENT PROJECTS ABSTRACTS SECTION

R261–0058 SIC 261 PULP, PAPER & WOOD GRANT NO. 803270

Activated Carbon Treatment of Kraft Pulping Bleaching Effluents St. Regis Paper Company P.O. Box 87 Cantonment, FL **PROJECT LIFE:** 07/74–09/75 **PROJECT COST:** $106,990 ($69,594)

The removal of color and organic contaminants by adsorption on activated carbon from the effluent of a kraft pulp bleaching plant was investigated in a pilot plant. The caustic bleach effluent, which contains 80% of the color from pulp bleaching, was decolorized successfully when it was adjusted to pH 2.5. The spent carbon was regenerated with caustic solution for a large number of adsorption-regeneration cycles before thermal regeneration was required. Variables studied included pH of feed, feed rate, effluent from bleaching of hardwood and softwood, caustic requirements for regenerating the carbon, and concentration of color in feed. Capital and operating cost estimates for a full-scale plant are presented. The effects of variations in design and operating conditions on costs are discussed. It was concluded that the process is technically sound, that it will remove 94% of the color and 84% of the total organic carbon from caustic bleach effluent from the bleaching of softwood, and that it has higher capital and operating costs than alternative methods of reducing color in bleach effluents. EPA CONTACT: John S. Ruppersberger

R261–0059 SIC 261 PULP, PAPER & WOOD GRANT NO. 803667

Advanced Filtration of Pulp Mill Wastes International Paper Company Corporate Research & Development Division P.O. Box 797 Tuxedo Park, NY **PROJECT LIFE:** 04/75–04/77 **PROJECT COST:** $272,400 ($100,000)

International Paper Company proposes in-plant tests of hyperfiltration and ultrafiltration techniques, utilizing dynamic membranes, applied to effluents from the kraft process. The basis for these techniques is the prior work conducted by the Water Research Program of the Oak Ridge National Laboratory. IP Co. proposes to sub-contract for support from ORNL. In a cooperative program under the ORNL-MSF Environmental Program, laboratory tests have indicated good prospects for early usefulness of these techniques in ameliorating several problems of the kraft process. One is the concentration of effluent from pulp washing by hyperfiltration. Another is removal of color and organic matter from the caustic solution generated in the bleaching process by ultrafiltration. In the first application savings of heat, water and chemicals appear likely to balance the cost of hyperfiltration, without allowance of credit for environmental benefits. This type of treatment of the bleach plant effluent appears considerably cheaper than any of the leading present alternatives. The unit proposed will be of about 1000 gpd capacity, and will be tested at the IP Co. mill at Moss Point, Alabama. Objectives are to confirm laboratory tests under field conditions, and to accumulate information necessary to estimate costs and to guide scale-up to industrial size. EPA CONTACT: Ralph H. Scott

R261–0060 SIC 261 PULP, PAPER & WOOD GRANT NO. 803302

Treatment of Sulfite Evaporator Condensate for Recovery of Volatile Components Flambeau Paper Co. Park Falls, WI **PROJECT LIFE:** 07/74–11/76 **PROJECT COST:** $3,407,521 ($500,000)

This project involves the operation of a mill scale plant to demonstrate the treatment of evaporator condensate. The aim is to show that soluble products and separate clean water, for reuse in the sulfite washing system, can be produced. The system proposes to recover methanol, furfural and ethyl acetate of industrial purity, as well as the recovery of sulfur dioxide for use in the making of cooking acid. EPA CONTACT: Ralph H. Scott

R261–0061 SIC 261 PULP, PAPER & WOOD GRANT NO. 800740

Minimizing the Pollutional Impact of Kraft Pulping Through Oxygen Bleaching The Chesapeake Corporation of Virginia West Point, VA **PROJECT LIFE:** 03/72–11/75 **PROJECT COST:** $12,160,000 ($438,938)

This project will demonstrate the practicality of operating a 300 ton per day three or four stage oxygen bleaching system for producing hardwood kraft pulp. The application of molecular oxygen to other unit processes including oxygen oxidation of black liquor will be investigated. In addition to being the first demonstration of oxygen bleaching in North America, the project will also be the first application of oxygen technology to be integrated into an entire mill system. The overall result of the project will be a bleached kraft effluent with significant reductions in organics, both BOD and color, and inorganics, particularly chlorides. EPA CONTACT: Ralph H. Scott

R261–0062 SIC 261 PULP, PAPER & WOOD GRANT NO. 804312

Color Removal from Kraft Decker and Bleach Effluents by Ultrafiltration Champion International Corporation Knightsbridge Hamilton, OH **PROJECT LIFE:** 02/76–02/78 **PROJECT COST:** $204,552 ($140,000)

The development of practical ultrafiltration technology to treat the highly colored kraft decker and caustic extraction bleachery effluents is the principle objective of this study. These two highly colored process streams contribute about 80–90% of the wastewater color from a typical bleached kraft mill. Successful application of ultrafiltration to treat these two process streams would contribute toward practical zero discharge technology. A 10,000 gpd pilot plant used in an earlier EPA supported project shall be refurbished and used to evaluate recent advances in membrane materials and hardware that are expected to enhance the economic attractiveness of ultrafiltration. Technical feasibility of ultrafiltration to treat decker and caustic extraction process streams was demonstrated under the previous EPA supported study. EPA CONTACT: John S. Ruppersberger

CURRENT PROJECTS ABSTRACTS SECTION

R261–0067 SIC 261 PULP, PAPER & WOOD GRANT NO. 804644

Determination of SO_3 Emission Levels in Kraft Pulping Liquor Recovery Furnaces National Council of the Paper Industry for Air and Stream Improvement, Inc. 260 Madison Avenue New York, NY **PROJECT LIFE:** 07/76–06/77 **PROJECT COST:** $48,760 ($24,350)

The objective of the project is to determine the sulfur trioxide levels in exhaust gas from kraft recovery furnaces. The approach is to measure sulfur trioxide levels using the method of condensation of SO_3 at its dew point in a sample which has been previously filtered to remove any sodium sulphate present. The findings should be beneficial in determining whether sulfur trioxide emissions from kraft recovery furnaces are of any significant consequence in air quality management programs. EPA CONTACT: John S. Ruppersberger

R261–0073 SIC 261 PULP, PAPER & WOOD GRANT NO. 804646

Chemical Characterization and Determination of the Relative Effluent Odor Contribution of Selected Process Streams National Council of the Paper Industry for Air and Stream Improvement, Inc. 260 Madison Avenue New York, NY **PROJECT LIFE:** 07/76–12/77 **PROJECT COST:** $62,640 ($31,300)

The objective of the work is definition of the potential odor contribution of selected process streams and mixtures of process streams in the kraft operation which are routinely sewered and to determine the relative effectiveness of air and stream stripping in reducing odor potential of these streams. The approach is to chemically and organoleptically analyze samples from representative mills both before and after the samples are air and stream stripped. EPA CONTACT: H. Kirk Willard

R261–0077 SIC 261 PULP, PAPER & WOOD GRANT NO. 800520

Closed Process Water-Loop in NSSC Pulp Production Green Bay Packaging Inc. P.O. Box 1107 Green Bay, WI **PROJECT LIFE:** 03/72–08/76 **PROJECT COST:** $626,820 ($300,430)

The primary objective of this project is to achieve the maximum closure of the process water-loop in an integrated neutral sulfide semichemical (NSSC) pulp and paperboard mill. Contaminated process water will be recycled for direct reuse. Excess surge volumes occurring during process upsets will be processed in a reverse osmosis plant to separate dissolved constituents from the process water. This permeate will be recycled and the separated solids will be destroyed in the fluid bed combustion system. Another objective of the project is to demonstrate the techniques required to stabilize operations and control ambient conditions in a tightly closed NSSC system. The result of this project will be the first detailed description of activities required to accomplish a closed process water-loop in a NSSC pulp and paperboard mill. EPA CONTACT: Ralph H. Scott

R261–0410 SIC 261 PULP, PAPER & WOOD GRANT NO. 804779

Elimination of Phenolic Materials in Bleach Wastes State University of New York P.O. Box 7126 Albany, NY **PROJECT LIFE:** 07/76–11/78 **PROJECT COST:** $135,855 ($86,530)

The project will examine conventional treatment systems as to efficiency in eliminating phenolic materials from bleach wastes while characterizing the microflora existing in the treatment biomass. Further research will seek to identify microorganisms capable of efficient destruction of phenolic type compounds and establish environmental conditions favorable for growth and reproduction of such strains in the hope that these types may be used to significantly increase the rate of destruction of phenolic compounds by biological processes. EPA CONTACT: H. Kirk Willard

R261–0411 SIC 261 PULP, PAPER & WOOD GRANT NO. 804971

Development of a Chemical Toxicity Assay for Pulp Mill Effluents B.C. Research 3650 Wesbrook Mall Vancouver, BC, Canada **PROJECT LIFE:** 03/77–02/79 **PROJECT COST:** $152,000 ($144,950)

The project will develop a chemical analysis procedure for rapid measurement of the concentrations of toxic materials in bleached and unbleached kraft and whole mill effluent, groundwood effluents and sulfite mill effluents and will attempt to relate the chemical assay results to effluent toxicity measured in bioassays using rainbow trout as a test animal. EPA CONTACT: H. Kirk Willard

CURRENT PROJECTS ABSTRACTS SECTION

R262–0070 SIC 262 PULP, PAPER & WOOD GRANT NO. 803347

Investigations of Heat Treatment as a Method of Sludge Conditioning for Reuse or Improved Dewatering National Council of the Paper Industry for Air and Stream Improvement, Inc. 260 Madison Avenue New York, NY **PROJECT LIFE:** 06/74–06/76 **PROJECT COST:** $59,092 ($29,546)

The project has two objectives. The first is to determine the suitability of the ash fraction of reclaimed deinking sludge after destructive heat treatment (wet oxidation), as a filler material in paper manufactured on a model paper machine at Western Michigan University. When high grade printed papers are deinked in the process of their preparation for recycle approximately 20 to 40% of the recycled paper weight is accounted for by inert filler materials consisting of clay and titanium dioxide. These inert filler materials account for as much as 60 to 80% of the sludge resulting from the treatment of deinking process effluents. Being impregnated with ink, the filler materials are not suitable for direct reuse in paper making and conventional incineration alters the chemical composition resulting in a product with extreme abrassive properties. Laboratory studies indicate wet oxidation produces a material satisfactory for reuse in paper making, therefore, offering an alternative to serious land disposal problems for waste treatment sludge from this process. Non-destructive heat treatment has been shown to be an effective means of sludge conditioning to permit mechanical dewatering. The second objective of this project is to examine in the laboratory the benefits of heat treatment on sludge dewaterability of hydrous sludges consisting principally of groundwood fines, those from chemically coagulated effluents from biological treatment and those from chemical-physical treatment of process water. All are characteristically extremely difficult to mechanically dewater, a necessary process in several forms of ultimate disposal. It is likely that the optimum form of conditioning may be a combination of chemical and heat treatment. This will also be investigated in the laboratory. EPA CONTACT: Victor Dallons

R262–0071 SIC 262 PULP, PAPER & WOOD GRANT NO. 803348

Investigation of Reuse Potential of Ash from Papermill Sludges National Council of the Paper Industry for Air and Stream Improvement, Inc. 260 Madison Avenue New York, NY **PROJECT LIFE:** 05/74–11/75 **PROJECT COST:** $47,120 ($23,545)

The objective of the proposed work is to determine if the inert filler materials, namely clay and titanium dioxide, which are used in paper manufacturing and a portion of which compose the sludge resulting from treatment of papermill waste, can be reclaimed with minimum reprocessing to substantially reduce a solid waste disposal problem. It is proposed to separate the clay and titanium from sludges generated during effluent treatment by selective screening. The recovered filler materials from two different types of printing papers (coated and uncoated papers) will be blended with virgin filler in the proportions they exist in the manufacturing operations and used to make paper on a model paper machine at Western Michigan University. Paper manufactured from 100 percent virgin materials will be used as a control. If these inert filler materials can be successfully reused as preliminary studies indicate to be the case, alternative methods of disposal for the remaining volatile sludge fraction such as incineration becomes available and a solid waste disposal problem will be diminished. EPA CONTACT: Victor Dallons